

MEDICAL LIBRARY

MAR 1 1937

Archives of
**PHYSICAL THERAPY,
X-RAY, RADIUM**

(Incorporating PHYSICAL THERAPEUTICS)

with

INTERNATIONAL ABSTRACT

Official Journal American Congress of Physical Therapy



16th Annual Session

AMERICAN CONGRESS OF PHYSICAL THERAPY

SEPTEMBER 20, 21, 22, 23, 24, 1937

NETHERLAND PLAZA

CINCINNATI, OHIO

Volume XVIII

FEBRUARY, 1937

No. 2

Lepel Short Wave Machine

with Flexible Electrode Arms



Pelvic treatment with air-spaced electrodes using flexible arms.

Three Application Methods

The machine enables the use of three different methods of electrode application: Condenser electrodes in the form of flexible pads, hard rubber cups, belts (cuffs) or discs; induction coil electrodes, to be either wound around the part to be treated or to be placed over it in the form of a flat pancake shaped coil; and direct contact metal electrodes for orificial application where it is desired to obtain a high temperature rise in a small area.



Chest treatment with induction coil electrode in pancake shape.

The new Lepel flexible arms represent an advance in Short Wave technique. The flexible members of these arms enable the electrodes to be placed in any desired position, a feature which distinguishes them from all electrode holders which are not flexible. No adjustment screws of any kind are needed to hold the arms in position.

The use of the disc electrodes, which come with the arms maintaining an air space between skin and disc so that the patient is not touched at all, is possible in conjunction with the Lepel Short Wave machine because this machine has an Ultra Short Wave component. The advantage as against electrodes which require felt or rubber spacing instead of air is evident particularly when treating a sensitive area in which the pressure of the spacing material would aggravate the pain.



Shoulder treatment with air-spaced cup electrodes strapped on.

Surgery Currents

of the finest quality are a feature of the Lepel Portable Short Wave machine. The portable machine has currents for desiccation coagulation without carbonization, and cutting with variable dehydration. Even monopolar cutting is possible with the Lepel Model SWP and its current lends itself beautifully for cervical conization (Hyams technique).

Prices from \$295 up

For full
information
mail
coupon.



Lepel High Frequency Laboratories, Inc.
39 West 60th Street, New York

APT257

Please send me full information and price of your short wave equipment.

Dr.....

Street..... City.....

Contents—Feb. 1937

Volume XVIII

No. 2

ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM

DISRAELI KOBAK, M.D., Editor

Suite 712 — 30 North Michigan Avenue, Chicago, Illinois

Original contributions, exchanges and books for review should be forwarded to the Editorial Office. All business matters including advertising should be handled through the Executive Office, Suite 712 — 30 N. Michigan Ave., Chicago, Illinois. The statements in the manuscripts published in the ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM, are made solely on the responsibility of the author. The American Congress of Physical Therapy does not assume any responsibility for statements contained therein. Manuscripts accepted for publication in ARCHIVES OF PHYSICAL THERAPY, X-RAY, RADIUM, are for exclusive publication and may not be published elsewhere.

OFFICERS AND BOARD OF GOVERNORS

American Congress of Physical Therapy

WILLIAM BIERMAN, M.D.,
New York, President.
FREDERICK L. WAHRER, M.D.,
Marshalltown, Iowa, President-Elect.
FRANK H. KRUSEN, M.D.,
Rochester, Minn., First Vice-President.
GRANT E. WARD, M.D.,
Baltimore, Second Vice-President.
WILLIAM J. EGAN, M.D.,
Milwaukee, Wis., Third Vice-President.
NATHAN H. POLMER, M.D.,
New Orleans, Fourth Vice-President.
FRED B. MOOR, M.D.,
Los Angeles, Fifth Vice-President.
JOHN STANLEY COULTER, M.D.,
Chicago, Treasurer.
RICHARD KOVACS, M.D.,
New York, Secretary.
MARION G. SMITH, B.S.,
Chicago, Executive Secretary.

EXECUTIVE COUNCIL

John Severy Hibben, M.D., Pasadena, *Chairman*.
Norman E. Titus, M.D., New York, *Secretary*.
John Stanley Coulter, M.D., Chicago.
James C. Elsom, M.D., Madison, Wisconsin.
Frank H. Ewerhardt, M.D., St. Louis.
Roy W. Fouts, M.D., Omaha.
Disraeli Kobak, M.D., Chicago.
Gustav Kolischer, M.D., Chicago.
Albert Frank Tyler, M.D., Omaha.
Frank H. Walke, M.D., Shreveport, La.
William Bierman, M.D., New York, *Ex-Officio*.

PUBLICATION COMMITTEE

DISRAELI KOBAK, M.D.
A. R. HOLLENDER, M.D.
ALBERT F. TYLER, M.D.
M. C. L. McGUINNESS, M.D.
RICHARD KOVACS, M.D.
WM. H. SCHMIDT, M.D.
FRANK H. KRUSEN, M.D.

Subscriptions — In the United States, its possessions, and Mexico, \$5.00 yearly; Canada, \$5.50; elsewhere, \$6.50 the year.

Advertising rates on application. All advertising copy subject to acceptance by publication committee.

Published monthly at Chicago, Illinois, by American Congress of Physical Therapy.

Entered as Second Class Matter June 2, 1930, at the Post Office at Chicago, Illinois, under the Act of March 3, 1879.

ORIGINAL ARTICLES

- Short Wave Currents.....William Bierman, M. D. 71
Short Wave Diathermy in Pulmonary Infections.....
.....Salvatore Fiandaca, M.D. 79
Cancer Therapy by Electrosurgery and Radium.....
.....Ira I. Kaplan, M.D. 92
Electroendotherapy in Combined Treatment of Tumors
.....Isabel M. Scharnagel, M.D. 95
Discussions of Drs. Kaplan's and Scharnagel's Papers
by: Drs. Grant E. Ward, Wm. H. Schmidt, Tibor
de Cholnoky, Isabel Scharnagel, and Ira Kaplan.
Electrical Shocks: Causes, Incidence, and Consequences.....
.....Douglas Macfarlan, M.D. 99
Discussed by Dr. Richard Kovacs.
Iontophoresis of Varicose Ulcers.....Joseph Kovács 103

SECTIONAL MEETINGS

- Program Mid-Western and Southern Sections..... 107
Program Eastern Section..... 108

EDITORIALS

- Present Concepts of Cancer Therapy..... 109

CORRESPONDENCE

- Short Wave Temperature Interpretations Questioned.. 111

SPECIAL SECTION

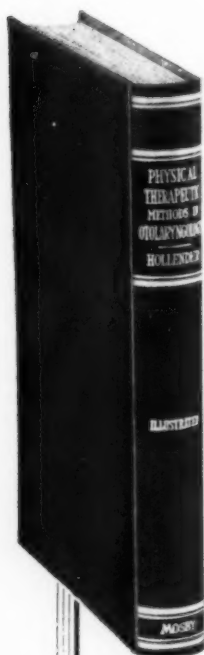
- Science, News, Comments..... 114

THE STUDENT'S LIBRARY

- Book Reviews 117

INTERNATIONAL ABSTRACTS

- Abstracts of Articles on Physical Therapy, X-Ray,
Radium, Biophysics and Allied Subjects..... 119



READY NOW!

PHYSICAL THERAPEUTIC METHODS IN OTOLARYNGOLOGY

By ABRAHAM R. HOLLENDER, M.D., F.A.C.S.

Associate in Laryngology, Rhinology and Otolaryngology,
University of Illinois College of Medicine.

422 Pages.

189 Illustrations.

Price, \$5.00.

Comprehensive in scope — and especially detailed in technic, this work should prove of inestimable value to the otolaryngologist. The general practitioner and the technician also should find this book of material help in treating ear, nose, and throat conditions with physical measures.

The basic chapters dealing with phototherapy, low voltage currents, phototherapy, long and short wave diathermy, x-rays and radium are up-to-the-minute in information, highly authoritative and concisely written especially for the otolaryngologist.

The otolaryngologist can no longer fail to recognize the rationale of physical procedures as aids to accepted methods of treatment. Only such technics are discussed as have been shown definitely to possess merit.

ORDER YOUR COPY TODAY

THE C. V. MOSBY COMPANY,
3525 Pine Blvd.,
St. Louis, Mo.

Gentlemen: Send me the new Hollender book on "Physical Therapeutic Methods in Otolaryngology," charging my account. The price is \$5.00.

Date.....

Dr.....

Street.....

City..... State.....

Contents

Part I

PHYSICAL AGENTS — PRINCIPLES AND EFFECTS

- | | | |
|-----------|-------------------------|------------------------------|
| Chapter I | Low Voltage Currents | |
| II | Diathermy | <i>Disraeli Kobak, M.D.</i> |
| III | Short Wave Diathermy | <i>Disraeli Kobak, M.D.</i> |
| IV | Electrosurgery | |
| V | Phototherapy | <i>William Bierman, M.D.</i> |
| VI | Ultraviolet Irradiation | <i>Frank H. Krusen, M.D.</i> |
| VII | X-Rays and Radium | <i>Albert F. Tyler, M.D.</i> |

Part II

PHYSICAL AGENTS IN OTOLARYNGOLOGY

- | | |
|-------|---|
| A. | The Nose and Accessory Sinuses |
| VIII | Affections of the External Nose and Face |
| IX | Acute Rhinitis — Acute Sinusitis |
| X | Ionization in Simple Chronic Rhinitis |
| XI | Ionization in Vasomotor Rhinitis |
| XII | Diathermy in Reduction of Inferior Turbinates |
| XIII | Chronic Sinusitis |
| B. | The Pharynx and Larynx |
| XIV | Röntgen and Radium Therapy of Hypertrophied Tonsils |
| XV | Electrosurgical Tonsillectomy |
| XVI | Status of Electrosurgical Tonsillectomy |
| XVII | Reduction of the Lingual Tonsil and Lymphoid Tissue of Pharynx |
| XVIII | Laryngeal Tuberculosis: Electrocautery Treatment |
| | <i>Edward A. Looper, M.D.</i> |
| XIX | Radiation Therapy in Laryngeal Tuberculosis |
| C. | The Ear |
| XX | Affections of the External Ear |
| XXI | Non-Suppurative Diseases of the Middle Ear |
| XXII | Suppurative Diseases of the Middle Ear |
| XXIII | Ionization in Chronic Otorrhea |
| | <i>A. R. Friel, M.D.</i> |
| XXIV | Ocular Nystagmus — Production by Physical Means and Clinical Evaluation |
| | <i>S. L. Shapiro, M.D.</i> |
| XXV | Hearing Aids |
| | <i>Horace Newhart, M.D.</i> |

Part III

NEOPLASTIC AND MISCELLANEOUS PROBLEMS

- | | |
|--------|-----------------------------------|
| XXVI | Endoscopic Approach to Therapy |
| | <i>Chevalier L. Jackson, M.D.</i> |
| XXVII | Benign Neoplasms |
| XXVIII | Malignant Neoplasms |
| | <i>Francis L. Lederer, M.D.</i> |
| XXIX | Miscellaneous Conditions |
| | Glossary |

SHORT WAVE CURRENTS *

WILLIAM BIERMAN, M.D.

NEW YORK

All heating by electric currents is basically of the same nature. At any point in a substance, the heat generated depends upon the electric field strength and the conductive current at that point. It is proportional to the product of these two quantities, and aside from magnetic effects involves no others. The problem of determining the distribution of heat in a mass of tissue when it is subjected to the action of diathermy or of short wave resolves itself into the determination of the electric field strength and the conductive current density at every point in the mass.

These two quantities vary in magnitude from point to point in the substance, and their distribution depends upon the geometric arrangement of the electrodes, the size and shape of the medium and the distribution of electric constants in the different parts.

It is necessary for us to distinguish between *conductive* current and *total* current. In a varying electric field, such as is produced either with a diathermy or a short wave apparatus, where the field changes its direction many times a second, the current at any point does not necessarily follow the electric field. To illustrate, when the electric field is a maximum, the current may not be at its highest value in the same path, and when the field intensity is reduced to zero preparatory to going in the other direction, the electric current may not simultaneously be zero, but have some value in either course. This phenomenon represents a difference in phase between the current and the field strength, or voltage. While both are varying in a sinusoidal manner, there is a time difference between the attainment of maximum value, the current reaching this state earlier or later than the field intensity. A current varying in this manner out of phase with the field intensity which produces it, may be considered as made up of two components. The one component is a so-called *displacement* current, which is completely out of phase with the field intensity. It attains its maximum at the instant when the field intensity is zero and runs through that point at an instant when the field intensity is at maximum. The other component we have called *conductive* current. It is entirely *in phase* with the field intensity, both attaining maximum at the same instant, the current passing through its zero value at the same moment as the field intensity. The actual current at any point is, of course, the total, that is, the sum of these two currents, and its phase is shifted with respect to field intensity. However, for the purpose of studying the power dissipation, that is, the conversion of electric energy into heat, it is necessary to separate the current into these two components, displacement and conductive currents, with the heat at any point being independent of the displacement current but proportional to the product of the conductive current and the field intensity.

The value of the conductive current and of the field intensity at any point in the medium, of course, depends not only upon the electric constants of the point in question, but also upon the electric constants of other parts of the media. The interpretation of the interaction of one part of a medium upon another is the most difficult part of the problem.

* Read before the Western Section of the American Congress of Physical Therapy, Los Angeles, California, June 18th, 1936.

In conventional diathermy, with a frequency of alternations relatively low as compared with the short wave, we may for practical purposes assume that the current at any point is wholly conductive. Under this condition, the current distributed through the medium depends upon the well-known constant of matter, *conductivity*. Such a simple idea as the current taking the path of least resistance is here applicable, and we can predict with some assurance the direction and magnitude of the current at various points by this simple concept. Since the current is entirely conductive, that is, completely in phase with the electric field, we may conclude that the heat developed at any point, being proportional to the current multiplied by the field intensity, is in fact proportional to the square of the current, the proportionality factor involving only the conductivity.

Heating of tissue by the short wave current is a process essentially similar to that produced by conventional diathermy. The chief difference between these two types is the magnitude of alternations. Diathermy currents reverse their direction about 1,000,000 times a second, whereas the short or ultrashort wave currents reverse their direction of flow from 10,000,000 to 50,000,000 or more times a second. This difference in rate of alternations causes some variation in the process of heating of tissue. The biggest point of distinction lies in the fact that for currents of low frequency the characteristic of the medium which determines the distribution of current flow is its *conductivity*, whereas for the currents of high frequency of alternation, the factor that determines the distribution of current is known as the *dielectric constant*, which differs from conductivity.

A mass of tissue which is homogeneous with relation to the characteristic known as conductivity may be very inhomogeneous with reference to its dielectric constants. The reverse also may be the case, that is, a mass of tissue may be homogeneous as far as the dielectric constant is concerned, but be inhomogeneous with relation to its conductivity. Different structures such as muscle, blood vessels, etc., have different conductivities, but all have essentially the same dielectric constant. This is a result of the fact that the dielectric constant of water is 80 — much higher than that of most other substances. Since water constitutes a large percentage of every tissue, the dielectric constant varies very slightly among different types of living material, with the exception of fat, which is relatively free from water.

It follows that while in diathermy the distribution of current in the body will be largely determined by the course of the better conducting layers, vascular structures, and the like, in the case of short wave these inhomogeneities are no longer of any significance in determining the distribution of the current because this factor depends not on conductivity but on the dielectric constant. With the short wave current the heat is not uniformly distributed, even in a case when current is uniformly distributed. In general, however, it can be shown that the differences in heat developed between different types of tissue for the same current are less pronounced with short wave than with diathermy. In fact, the higher the frequency, the more uniform will be the distribution of heat among different kinds of tissue.

In diathermy we are accustomed to the conception that for the same current tissues of higher resistance (lower conductivity) will be heated more strongly. This idea is not applicable when the frequency becomes high, as in short wave. For every frequency there exists a type of tissue of a certain specific resistance for which the heating is a maximum. In general, the higher the frequency (the shorter the wavelength), the less the specific resistance of the tissue which is capable of being heated most strongly by the passage of a definite short wave current.

It is impracticable in a specific case to arrive at a definite quantitative idea of the distribution of heat in tissues, and the effect of changes in frequency upon this distribution. The best we can hope to do is to arrive at a qualitative appreciation. The situation with short wave applications is simpler than with diathermy, because for the former we may without serious error consider a tissue to be homogeneous in the sense of determination of distribution of current. Since the differences in heating of different types of tissue are less pronounced with short wave, we may qualitatively arrive at an estimate of the distribution of heat directly from the picture of the distribution of current.

Another very important difference between the high frequencies of short wave therapy and the low frequencies used in diathermy lies in the ability of the short wave currents freely to traverse a complete gap in the conducting circuit. Such a gap exists in the usual method of applying short wave therapy between the electrodes and the patient. The resistance of such an air gap is enormously high and for this reason conventional diathermy currents would be unable to pass the gap. The dielectric constant of air, however, is still sufficiently large to permit the passage of high frequency currents, the distribution of which is virtually independent of resistance. The lines of the flow of current in the air space between the electrode and the patient depend upon the geometric relations. For example, if a small electrode is placed near a large body, the flow in the air space will spread out. On the other hand, if a large electrode is placed near a body which is small compared to the electrode dimensions, the lines of current flow will tend to converge. It is for this reason that the size and spacing of electrodes is an important consideration in the therapeutic application of the high frequency currents.

There has been a tendency in the past to imagine that in diathermy the lines of current flow directly from one electrode to the other. This is, of course, far from actuality. The field establishes itself accompanied by a spread through a large part of the medium. In most instances the concentration of current is greatest at the electrode and diminishes in value as it penetrates the tissue. There is a tendency for more heat to be developed in the region between two electrodes placed close together, but if the electrodes are any distance apart, the heat developed near them represents practically all of the energy, while that developed in the rest of the body becomes diffused. If the body to be heated were small as compared with the electrodes, and these were so arranged that the current must flow through the part to be heated, heating would be uniform and throughout the entire space. Similar considerations apply in short wave.

Heating by Short Waves

In a large homogeneous body exposed to the field between two properly spaced plates, the lines of flow and the heating are essentially the same that would be obtained with diathermy, with contact plates of somewhat larger size than those used in short wave. In a small body, the lines of induction tend to bend in and fill it so that the heat is essentially uniform, with possibly somewhat greater heating at the center. Such an effect can be produced with diathermy by using cuff electrodes. The field would then be very similar and the heating have essentially the same distribution.

With a homogeneous body, then, it appears to be possible to duplicate with diathermy the distribution which would be obtained with short wave, and the principal virtues of short wave lie in the ease of application, since a direct contact is not required, and in the more homogeneous heating of the elements of a heterogeneous body.

A bovine thigh was heated by diathermy and by short wave. The electrodes in each case were placed in the position indicated for the most uniform heat, the diathermy plate over essentially exposed muscle and the short wave plates across the bone. With diathermy the temperature distribution was far from uniform. Near one electrode the temperature rose very much more than near the other because of a thick layer of fascia. The bone and marrow became heated not at all. The temperature in the fascial layers between the muscle was higher than in neighboring muscle tissues. The reason for these differences lies, of course, in the variations in conductivity between fascia, muscle, and bone. With short wave, on the other hand, the heat of the muscle and fascia was essentially the same. The temperature of the bone was also raised to practically the same level, while the marrow remained somewhat cooler. The entire impression is certainly that of much more uniform heat. The layer of fat surrounding one-half of the section was not heated unduly in the short wave field, whereas if it had been possible to pass diathermy in the same direction, this fat would have burned. (There was no skin covering this fat.)

These observations clearly indicate that on the basis of the physical characteristics of the currents and of animal tissue, it should be possible to exert a more uniform heating effect upon the tissue lying beneath the surface of the body by means of the short wave than by diathermy.

Living tissue differs greatly from dead tissue in that it possesses a rapidly circulating medium which can carry heat away from the region where it is produced. The most direct way of determining the actual temperature produced within tissues is by thermocouples. We have conducted numerous experiments to demonstrate the effect of short wave currents when applied to the thigh of the living human subject. The technic which we have usually employed consisted in the application of cuff electrodes above the knee and as high up on the thigh as was consistent with comfort. Determinations of cutaneous, subcutaneous, and intramuscular temperatures were made before and after application of the short wave current. These investigations indicated the development of substantial elevation of temperature within the intramuscular area as well as in the subcutaneous region and on the skin surface. Parallel technic resulted in comparatively slight elevations of temperature of the tissues lying between the plates.

In our experiments on the living human subject we used felt pads to separate the condenser electrodes from the skin surface. We found that if during the treatment the felt became saturated with sweat, our subject would complain of an uncomfortable degree of heat, and the depth temperatures, when taken by thermocouple, were comparatively low. On placing a thin layer of oiled silk between the skin surface and the felt pad, we were able to utilize greater amounts of current with increased heating at a depth and diminished heating on the skin surface. The moistening of the felt by sweat diminished the dielectric spacing. The presence of sweat between the oiled silk and the skin did not interfere with effective heating.

We have had the opportunity of testing a number of apparatus producing currents of wavelengths varying from 6 to 18 meters. We have found no substantial difference in their heating of living tissues at a depth. We ascertained, however, that the extent of the spacing between the condenser electrode and the skin surface was definitely influenced by the variations in wavelength. With the shorter wavelengths we were able to keep the condenser electrodes at a greater distance from the skin surface. With longer wavelengths it was necessary to bring the electrodes closer to the skin surface in order to secure good heating effects.

With orificial electrodes it is possible to raise the temperature of the tissues in the pelvis. This can be accomplished in the male with a rectal and in the female by a rectal or a vaginal electrode. The temperatures produced resemble those obtained by the application of diathermy. In both instances the height of the temperature elevation is limited by the tolerance of the tissues. As in the application of diathermy, we observe that if the current energy is not increased the maximum temperatures are not sustained. In applying the short wave current we find that the best results are obtained with a metal vaginal electrode. The other electrode can be placed near any part of the body some distance away from it. The length of cord connecting the vaginal electrode to the short wave apparatus appears to be a factor. For example, with one apparatus the best results were secured with a cord four feet long. The use of a glass condenser vaginal electrode has proved comparatively ineffective. The patients complained of discomfort, the temperatures developed were relatively low, and occasionally burns were produced.

The use of other technics to cause elevation of pelvic temperature, such as the placing of an electrode on the abdomen and another underneath the buttocks, or the placing of one electrode against the perineum and the other on the abdomen, did not cause any substantial elevation of temperature within the pelvis. We have found that the diathermy current when applied with similar technics also proved comparatively ineffective.

Nasal and Paranasal Heating

Because of the clinical use of short wave current in the treatment of paranasal sinusitis, we have investigated the temperature elevations produced in some parts of the head by means of this current. The technic employed was the application of a condenser electrode on the face and the other on the region of the back or on the buttocks as the patient sat on this electrode. The temperatures of various parts examined were determined before the short wave current was applied, and then again after a ten minute period of application. A special thermocouple was used. No readings were made while the short wave current was turned on.

The areas investigated were the intranasal region of the middle turbinate, the antrum, and the sphenoid. These investigations indicated definitely that it is possible to elevate the temperature of the intranasal, antral, and sphenoid areas by means of short wave current. The degree of elevation is comparatively slight. It cannot, however, be explained by the influence of the current application in elevating the systemic temperature. Many of the temperature readings were lower after the application of the short wave current than before its application. In all of these instances, the topical application of a cocaine and adrenalin solution caused an initial lowering of the temperatures, which was frequently not offset by the subsequent use of the short wave current. When the temperature before the treatment was high, as in acute inflammatory conditions and in cases recently operated upon, the degree of temperature elevation after the application of current was minimal.

Whether or not there is any effect other than heat on applying the short wave current to animal tissues, is controversial. The possibility exists, as indicated by the work of many investigators. However, the most definite determinations we have thus far made would lead us to the conclusion that the special changes which have been described as taking place in tissues following the application of short wave currents, may be explained on the basis of temperature elevation.

Many biologic changes occur as a result of temperature elevation of living tissues. We have referred to some of these.¹ They include the production of an active hyperemia with dilatation of blood vessels, increased permeability, changes in capillary and intracellular pressure values,² chemical changes such as those in pH, and carbon dioxide and oxygen content,³ increased phagocytosis,⁴ and the like.

Clinical Effects

Consideration of the physical and physiologic changes is important logically to explain the clinical results. Clinical impressions, to become definite, must be based upon observations of thousands of cases of many different patients over a period of several years. Inasmuch as this therapy is relatively new, the number of cases treated has not been sufficiently large nor the length of time sufficiently long to permit more than impressions. As a result of our clinical experience we have come to the conclusion that generally the short wave current may be used for those conditions for which medical diathermy has proved of value. These conditions include such pathologic states as bursitis (especially about the shoulder joint), traumatic tenosynovitis, myositis, myofascitis, sprains, and arthritis. The types of arthritis treated with most satisfactory results are the traumatic and gonococcal. The problem of infectious or rheumatoid arthritis is complex owing to the focal and systemic factors. Local joint heating is one of the adjuncts in the treatment of this condition. In many of our patients the vertebral and the sacroiliac joints were involved. Here, as in many other parts of the body, we have found a horizontal technic to give the most satisfactory results. In this technic the electrodes are placed on each side of the area rather than anteroposteriorly. We believe that the results obtained by short wave currents in the treatment of these conditions is superior to those with diathermy. Here, as in all other conditions where heat is applied, the question of dosage should be kept in mind. We have, for example, observed aggravation of the pain about the sacroiliac joint following short wave treatment, where reaction to diathermy was decidedly less severe. The ability to create a greater amount of heat may be a disadvantage. Because of its greater ease of application, and owing to the fact that it is not necessary to place any object in contact with the skin during its administration, short wave current applications present numerous advantages in contrast to those of diathermy. It is possible, for example, to treat very tender areas, such as parts recently injured accidentally or purposely, as after cosmetic surgery. For the same reason it is possible to treat areas made tender by local infections, such as boils and carbuncles.

It has been thought that some special effect other than that of heating accounts for the particularly beneficial influence of short wave currents upon localized infections. It is our view that the effects produced may be explained solely on the basis of the heating of the involved areas. We have treated such diverse infections as axillary abscesses, infections of the finger, carbuncles of the neck, infected pilonidal wounds (after surgical excision), furuncles of the nose and face, infected cervical glands, chronic osteomyelitis (with drainage), and chronic purulent otitis media. Our impression is that the short wave current is of great value in the treatment of these conditions, but must be used with surgical judgment.

It appears to be possible frequently to abort localized acute infections in their early stages. Very often, however, if the inflammatory process goes on to suppuration, pus develops much more rapidly than it would without the treatment. When it does occur, it is our practice to provide drainage

surgically unless it takes place spontaneously. We deem it erroneous to treat acute suppurative processes without drainage.

We have also observed what we believe to be an unusually rapid spread of infection following the application of short wave currents. In this case, it is our opinion that the limiting mechanisms which the body employs to keep the infection localized to a given area are disturbed by the increased flow of blood. We therefore believe that the treatment of acute infections by means of short wave currents must be used with clinical judgment.

There is nothing new in the application of heating procedures for the treatment of local infections. Warm poultices have been used for many years. We have availed ourselves of conductive, convective, and conversive heat from radiant sources for a long time. It is therefore not necessary to ascribe any specific effects to the short wave currents upon microorganisms to explain the beneficial influence of a procedure which creates heat greater than any other measure used thus far. It is our definite impression that when drainage does exist, the infected process usually appears to heal very much more rapidly than with any other form of treatment. It has generally been considered that diathermy is contraindicated in the treatment of acute local infections. It would, of course, be a matter of difficulty to apply diathermy electrodes over acutely inflamed areas.

Our experience leads us to believe that the use of heat is of value in the treatment of paranasal sinusitis. We have seen individuals suffering from pains due to the involvement of ethmoid, sphenoid, frontal, and maxillary sinuses secure rapid and marked relief following the application of diathermy applied by a specially constructed cast, and following the use of the short wave currents. Many of these patients had for years been under treatment by nose and throat specialists. Rhinologists should add this form of treatment to whatever else is of value in treating both acute and chronic sinusitis. Here, as elsewhere, the surgical principle of adequate drainage is an important one.

The vaginal electrode (which may be attached directly to the short wave apparatus or through the intermediary of a variable condenser) permits of the use of this apparatus for the treatment of pelvic conditions in which diathermy has been proved useful. We have employed it to supply additional local heating in the pelvis while we have elevated the systemic temperature of our female patients in the treatment of gonorrheal infections.

Short wave current has the advantage of ease of application not only over infected areas, but also other regions where the irregular contour of the body surface renders the direct application of an electrode a matter of difficulty. Such regions are those of the ear, the eye, the nasal sinuses, and the like.

It is possible to cause the elevation of systemic temperature by employing small condenser electrodes supplied with short wave apparatus for local heating. The technic we have used consists in first wrapping the patient in a sheet and then in two blankets separated by rubberized cloth. The condenser electrodes are applied to the upper back and to the posterior aspect of the region of the mid-thigh. Within a reasonable period of time, such as an hour to an hour and one-quarter, it is possible to elevate the rectal temperature to about 106 degrees F. This procedure renders it possible to utilize the ordinary short wave machine for the treatment of the numerous diseases for which systemic temperature elevation has been shown to be of value.

To achieve the best results it is necessary to have some knowledge of the technic of application. The condenser plates should be held at a distance of about one-half to one inch away from the area treated. Schliephake⁵

insists that no material be interposed between the condenser plates and the surface of the body (aside from his glass shoes), while others feel that good results may be obtained if the condenser plates are kept away from the surface by felt pads or towels. It is best to remove the clothing from the part to be treated and care should be taken to exclude any metallic objects from the field.

An agency sufficiently potent to produce considerable elevations of local tissue temperature is not devoid of possibilities for harm. Burns can be produced if the application is made carelessly or to a region which is anesthetic, so that the patient cannot experience the sensation of thermal discomfort. Such burns have been reported.⁶

The multiplicity of apparatus manufactured during recent years makes the choice of one a matter of some confusion. The physician may be guided by the Council on Physical Therapy of the American Medical Association which has been investigating the value of different makes. There is no doubt that the short wave currents have added an extremely valuable instrument for the treatment of human ills.*

471 Park Avenue.

References

1. Bierman, W., and Fishberg, E. H.: Some Physiologic Changes During Hyperpyrexia Induced by Physical Means, *J. A. M. A.* **103**:1354 (Nov. 3) 1934.
2. Landis, E. M.: Microinjection Studies of Capillary Blood Pressure on Human Skin, *Heart* **15**:209 (May) 1930.
3. Bazett, H. C., and Sribyatta, L.: Effect of Local Changes in Temperature on Gas Tensions in Tissues, *Am. J. Physiol.* **86**:565 (Oct.) 1928.
4. McCutcheon, M.: The Effect of Temperature on the Rate of Locomotion of Human Neutrophilic Leucocytes in Vitro, *Am. J. Physiol.* **66**:185 (Sept.) 1923.
5. Schliephake, E.: *Short Wave Therapy*. The Actinic Press, London, 1935.
6. Kling, D. H.: Burns Produced by Radio Short Wave and Ultra-short Wave Therapy and Their Prevention, *J. A. M. A.* **104**:1981 (June 1) 1935.

* Note: I am indebted for that part of the paper devoted to the physical characteristics of the short wave current to Mr. Myron Schwarzschild, our physicist.

SHORT WAVE DIATHERMY IN PULMONARY INFECTIONS *

SALVATORE FIANDACA, M.D.

Assistant, General Medical Clinic of the Royal University of Palermo (Prof. Ascoli)

PALERMO, ITALY

Attempts to apply short wave therapy, though of relatively recent date, are already numerous and the results attained can, in a certain sense and for certain diseases, be considered satisfactory. One field where the application has proved particularly helpful is that of suppuration, superficial or deep. The undoubted credit goes to Schliephake for having first introduced the application of the short wave to this field, and his observations embrace furuncles, carbuncles, circumscribed phlegmons, folliculitis and similar infections.

Even in pulmonary suppurations the first attempts were made by the same author; they involve many cases of pleural empyema and of pulmonary abscesses which were subjected to intensive treatment by short waves with excellent results. In all cases Schliephake was able to bring about a cure of the infection, with the exception of two cases in which autopsy disclosed the co-existence of bronchial carcinoma. Recently Liebesny reports having received in four out of six cases of pulmonary abscess noteworthy, favorable results. The lack of efficacy of this therapy in the two cases, according to this author, was due to insufficient dosage.

Opposed to these observations, however, are other reports. On this matter, Hayer, in a note in which he summarized the results observed in various infectious forms treated with the short wave, reports failure to gain any appreciable advantage in one case of pulmonary abscess. More recently Krusen, in a note on preventive therapy with the short wave, casts a doubt on the signal results of Schliephake affirming that it is difficult to cure pulmonary abscess by this type of therapy.

We will refer in this report to a number of observations made by us and also the results secured during a period of about 18 months, when many cases were given treatment by the short wave method. Our observations began in October, 1933, and the first favorable results were already noticeable in March, 1934. The management of the cases treated until that time and the relatively brief period during which the observations were made, did not permit stressing of the immediate benefits nor a definite conclusion. At this time, however, with a larger number of cases and observations over a longer period of time, it is possible to present details with greater certainty.

Method of Study

We have made therapeutic use of apparatus by Siemens, one of which yielded about 500 watts and wavelengths fixed at 4, 8 and 15 m., and another "Ultrapandoros," also of about 500 watts, with a wavelength varying from 3.30 to 7 m. and fixed at 15 m. The treatment was always given by applying one of the air condenser electrodes on the anterior and the other on the posterior wall of the chest corresponding to the lesion. The electrodes varied in diameter from 16 to 10 cm. Encased in glass, they were applied to the chest which was covered preferably with a woolen shirt, care being taken that the two composite electrodes were as parallel as possible.

* Translated from the original Italian manuscript.

The following dosage was utilized. In all cases the first two treatments lasted 5 minutes; these were followed by seances of 10 to 15 minutes, and the succeeding ones up to 20 minutes. The course of treatment was divided in periods of 6-9 days, during which the applications were given daily. Between periods we allowed an intermission of 1 to 5 days. The intensity of dosage was regulated in every case individually according to the patient's tolerance. For this purpose we were guided by the sensation of heat experienced by the patient, and regulated the apparatus as to administer the maximum dose sustainable without causing a burn. In all cases, we utilized a 15-meter wavelength.

Report of Cases

CASE I. — Peter L., 36 years old, auto driver, from Alimena, Palermo. Anemic family and vague personal knowledge of family history. A year ago was stricken with croupous pneumonia. After a few weeks of apparent recovery, he began to cough with an abundant mucopurulent expectoration. The temperature rose to 38-39 degrees C. with pain of a piercing type over the right shoulder. These phenomena continued invariably for some time. The expectoration increased gradually and became intensely fetid. At our clinic we suspected a pulmonary abscess of the superior right lobe, and various remedies were tried (alcohol, collapse therapy, salvarsan) without any appreciable result. He later returned for observation in a worse condition. He manifested asthenia, anorexia, rising temperature, cough with abundant fetid expectoration (80-100 ccm. per day), pain in the right shoulder.

Physical Examination. State of malnutrition; skeletal development normal; muscles hypotrophic and hypotonic; pallor; generalized adenopathy. Examination of the respiratory apparatus revealed that the right half of the chest expands less than the left, especially on the upper side; vocal fremitus diminished at the upper and right subclavian fossa; increased posteriorly throughout. On percussion the sound is dull, with slight tympanic resonance in the region of the infraspinatus. Auscultation of the interscapulo-vertebral and infraclavicular right region revealed amphoric sounds with numerous loud, crepitant and mucous rales.

Radiologic examination of the right side showed the presence of a large opacity and non-uniform transparency that occupies a great part of the superior and of the median lobes, at the superior border a small rete, inferiorly less definite, especially at the interlobes, and notable enlargement of the hilus shadow.

In the radiograms secured during the first visit of the patient to the clinic it was not possible to obtain stereoscopically radiological evidence of definite cavities. Later comparisons confused the radiologic findings owing to reactive processes and sclerosis of pleural origin.

Diagnosis: Pulmonary abscess, metapneumonic, limited in great part to the right superior and median lobes.

Treatment was initiated with the short wave of 15 meters, consisting of two series of seven applications, separated by 4 days of rest. Improvement was immediate as evidenced by the cessation of pain. On the 5th day the fever disappeared, while the cough, diminishing in intensity, continued to persist to the end of the course. The expectoration was reduced to about 5-10 ccm. per day, was prevalently mucous in character and did not present the characteristic fetid odor. The general state improved noticeably; the patient gained weight (about 10 pounds); the asthenia disappeared, the appetite was stimulated. Even the objective signs showed a palpable retrogression, that is, diminution of the size of the amphoric area, and disappearance of the moist state; there persisted a slight vocal fremitus except at the subclavicular region. At the same region amphoric respiration was perceived with some rhonchi and rales.

Radiologically, the opacity on the right side was observed to be reduced to a reticular mesh; a reduction of the inspissation of the interlobe; while the hilus shadows continued to exist.

The patient at various times has been examined by us; he is today, after about a year and a half, in the best of health and does not present any clinical signs of the old suppurative process.

CASE 2. — Giuseppe, D. F., 18 years old, bricklayer, from Agira (Enna). When 16 years old he had pneumonia, from which he fully recovered. The actual disease started a year ago with a high temperature (38 degrees C.) of the intermittent type, cough with hemorrhagic expectoration. Sought relief at the clinic where he was diagnosed to have multiple echinococcus cysts at the inferior right and at the left superior lobes. He was given pneumothorax treatment, during which the patient coughed up numerous daughter cysts. He remained at the clinic for a number of months, continued to complain of a cough with little expectoration, and moderate rise of temperature. Last December he unfortunately was attacked by fever (39 degrees C.) and after a number of days coughed up about 500 ccm. of liquid material. Returning to our observation, he complained of pains of the breath taking type at the base of the right side of the chest and the left shoulder, cough, abundant mucopurulent expectoration (100-150 ccm. per day), non-fetid, sometimes streaked with blood. The temperature reached a maximum of 38 to 38.5 degrees C.

Objective Findings: The patient is in bad general condition; normal skeletal development; hypotrophic and hypotonic muscles; panniculus adiposus poor; skin pallid, moist; mucous membrane pale rose in color; generalized adenopathy.

Examination of the respiratory apparatus reveals diminution of respiratory mobility of the right chest, especially at the base; vocal fremitus diminished at the interscapulo-vertebral and subclavicular right region, at the base of the right entrance posteriorly, at the angle below the shoulder blades; costal points of Vallerix, painful at the right 5th, 6th, 7th, 8th, 9th, and at the left 2nd, 3rd, 4th, and 5th ribs. Percussion yields a flat sound in the left interscapulo-vertebral and subclavicular regions; dull sound at the right chest base; on auscultation we note vesicular breathing, medium and large rales consonant with expiration. At the same time one hears in the subscapular and left interscapulo-vertebral region rhonchi and some small and medium rales.

Radiologic examination shows at the right a large cavity shadow that occupies about half the inferior of the right chest, containing air and fluid; the opacity is due to the presence of liquid in the pleural cavity; the pleural diaphragm is not visible at the left. At the region of the hilus a shadow about the shape and size of a pigeon's egg, dense, and surrounded by a small rete.

Diagnosis: Pulmonary abscess, from suppurative echinococcus cysts, affecting the inferior half of the right lung, with slight pleural effusion; pulmonary infiltration in the region parallel to the left superior lung, tending to liquefaction.

After seven days rest in bed, during which time the symptoms had not changed, we initiated treatment with the 15-meter wavelength. The treatment was followed daily for 10 minutes during the first days, then for 15 minutes until the fourth day, and for 20 minutes during the remainder. The condition changed from the beginning of the course. On the 3rd day the fever disappeared, expectoration became reduced to about 10-15 ccm., the pain, which had been the most annoying symptoms, was greatly lessened.

On the 7th day when the symptoms had about disappeared and the patient's general condition was greatly improved, a new factor intervened to change the scene — vomiting. The patient emitted about 300 ccm. of thick yellow liquid, with some streaks of blood. At the same time the temperature reached 39 degrees C., the pain reappeared and the general condition became worse. Physical examination revealed the vocal fremitus to be somewhat increased at the base of the right chest corresponding to the 8th or 9th intercostal space in the paravertebral and scapular lines. Percussion of that region had a slight tympanitic character, while in the subscapular and interscapulo-vertebral regions of the same side as well as above anteriorly at the 3rd intercostal space the percussion sound was hypophonic.* Auscultation revealed amphoric respiration at the right base, small rhonchi with medium and large vesicular sounds on in- and expiration. The objective findings on the left side remained unaltered. Radiologic study showed a reduction of the shadow of the cavity at the right base with the pleural opacity slightly cleared up. A small quantity of fluid was noted at the costo-diaphragmatic recess, while the left opacity appeared to be unchanged.

* The term "hypophonic" is not commonly used in this country. It implies lowered resonance or pitch of tone.

The appearance of this attack of vomiting during the course of treatment when all factors seemed to be well under control, is not easy to explain. From all tests made we may rule out the left lesion as an etiologic factor and ascribe the cause to the right lesion, analogous observations having been made also by Schliephake.

The treatment was stopped for two days, when it was resumed and continued for 7 consecutive days. During this period we succeeded in gradually reducing the fever until it disappeared, in lessening the cough and in reducing the expectoration to a few cubic centimeters. Correspondingly the pain abated in intensity.

At this phase the treatment was again interrupted, the symptoms continuing to improve until they disappeared completely. The patient, however, continued to complain of slight pain in the right chest, which finally disappeared, with the pain in the left shoulder continuing. The general condition showed considerable improvement with a gain in weight of 5 pounds. On physical examination vocal fremitus at the base of the right chest showed a persistent slight increase, while the pleximeter elicited a slightly hypophonetic sound in the region posteriorly from the 8th intercostal space downward and from the paravertebral line to one centimeter outside of the scapular line. Auscultation revealed harsh sounds with some sibilant rales and light pleural friction sounds.

Radiologic examination made at the conclusion of the treatment showed a reduction of the size of the cavity with inspissation of the surrounding margin, diminution of the pleural opacity and disappearance of the effusion.

CASE 3. — Giovanni, C., 44 years of age, bricklayer from Palermo. Two years ago he was stricken with left lobar pneumonia, from which he recovered after about 20 days. There remained cough with slight expectoration, especially during the winter season. Three months ago he suffered from an attack of chills, followed by a rise of temperature to 39 degrees C., and pain in the left chest. Six days later the temperature returned to normal, and the pain abated, but there appeared cough with abundant expectoration (100-150 cc. per day). For a month he complained of recurrent fever (37.5-39.0 degrees C.), intense pain in the left chest at the 5th, 6th and 7th intercostal spaces, frequent coughing with abundant sweetish-fetid expectoration, discomfort, asthenia and loss of weight. He had been given various remedies (balsamics, emetin, neosalvarsan) without any benefit.

Physical Examination. General nutrition below par, typical facies, forced to lie on his right side, as the left position provokes attacks of cough. The chest is symmetrical, cylindro-conical in shape. Typical abdominal breathing with the left expanding less than the right chest. Palpation showed increased resistance on the left side, vocal fremitus is diminished in the left subscapular, subaxillary, subspinous and interscapulo-vertebral regions. Percussion yields a hypophonetic sound corresponding with the regions just enumerated, but especially marked in the subclavicular region. Auscultation reveals diminished vesicular murmurs in the left subaxillary and subclavicular region where also a number of large and small rales are heard on expiration.

Abundant rouleau expectoration of a fetid, yellow-greenish sputum in quantities of 250-300 cc. per 24 hours. Microscopic examination shows an abundant bacterial flora of bronchial type with numerous elastic fibers. There were neither spirochetes nor tubercle bacilli.

Radiologic examination revealed an extensive area of opacity virtually homogeneous in density, the margins softening and fusing with the normal pulmonary tissue and arranged like a girdle across the middle zone of the left chest (fig. 1).

Diagnosis: Gangrenous abscess of the middle part of the left lung adjacent to the interlobar space.

This patient was given 18 applications of two equally divided periods, but with the exception of a diminution of the fever there was no other evidence of improvement. On the contrary, during the first seances it was noted that the expectoration had increased and occasionally assumed a san-



Fig. 1

Fig. 2

Fig. 1. — Reveals an extensive area of opacity virtually homogeneous in density, the margins softening and fusing with the normal pulmonary tissue and arranged like a girdle across the middle zone of the left chest. Fig. 2. — Examination undertaken after the conclusion of the last period of treatment revealed marked diminution of the opacity, which appeared reduced as a narrow line corresponding to the left interlobar space.

guinous character. The discomfort and asthenia, too, appeared to have become aggravated.

A second course of short wave diathermy consisting of two periods, each of 9 seances, was then instituted. During this course the fever disappeared, the expectoration became diminished, finally being reduced to 20-25 ccm. per day, with the general state of the patient greatly improved.

Objectively at the end of the fourth period of treatment we noted dullness in the left subclavicular, subspinous and interscapulo-vertebral regions with rough respiratory sounds, disappearance of pain, and the moist state no longer evident.

Radiologic examination undertaken after the conclusion of the last period of treatment (the individual treatments of which were given on alternate days) revealed marked diminution of the opacity, which appeared reduced as a narrow line corresponding to the left interlobar space (fig. 2).

CASE 4. — Providenza, B., 12 years old, from Palermo, had suffered for several years from disturbances of the respiratory apparatus, cough with mucopurulent expectoration without fetor and frequent rise of temperature. A year ago he was brought to this clinic where a diagnosis of congenital bronchiectasis was made and treatments given, among them 22 seances of short wave diathermy. He left the clinic improved, but returned after six months complaining of cough and abundant fetid expectoration, temperature elevated to 38.5 degrees C., pain in the inferior half of the left chest.

Objectively the chest revealed diminution of respiratory mobility on the left side, diminished vocal fremitus at both pulmonary bases, especially to the left of the angle of the scapula downward, slight pain at the costal points of Valleix at the 5th, 6th, 7th and 8th left intercostal spaces, dull sound at the base of the left chest from the 7th rib downward along the angle of the scapula, and from the 5th rib downward to the median axillary line. On auscultation at the left posterior base back of the 7th, 8th and 9th intercostal spaces we noted bronchial breathing, small and medium rhonchi, with small, medium and large rales being heard also in the superior part of the left and at the base of the right chest.

Radiologic examination (fig. 3) shows the presence of an apparently empty cavity with a surrounding infiltration corresponding to the region of the left hilus, without the opacity showing any effusion.

Diagnosis: Bronchial abscess in the region lateral to the left pulmonary hilus.

Short wave treatment was carried through 28 seances divided into 4 periods of 7 applications. By the end of the first application beneficial effects were noticed. The symptoms retrogressed slowly and gradually in a

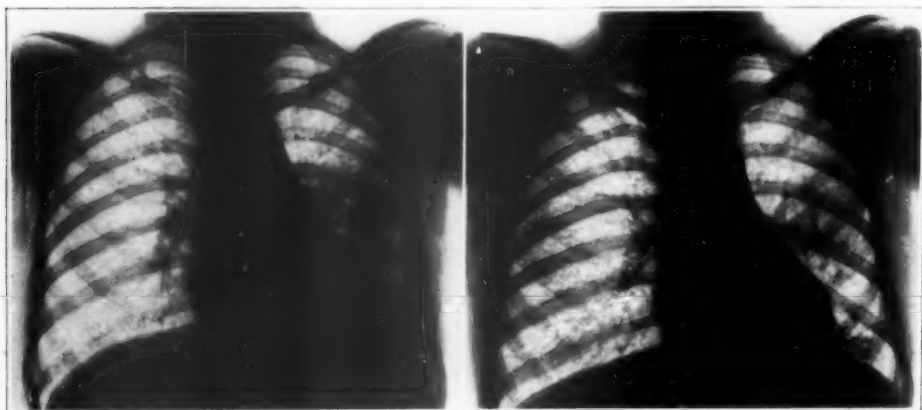


Fig. 3

Fig. 4

Fig. 3. — Shows the presence of an apparently empty cavity with a surrounding infiltration corresponding to the region of the left hilus, without the opacity indicating any effusion. Fig. 4. — The cavity appears reduced in size, the pleural infiltration has virtually disappeared with the pulmonary structure more clearly outlined.

comparatively brief period, without a return of the infectious process so frequently seen in other cases after the first applications.

At the end of the course the patient had gained in weight and did not complain of any symptoms. Physical examination revealed a slight diminution of fremitus at the left base of the chest, where we noted also amphoric breathing without a moist state.

Radiologically (fig. 4) the cavity appeared reduced in size, the pleural infiltration had virtually disappeared with the pulmonary structure more clearly outlined.

CASE 5. — Francesco, R., 52 years old, bachelor from Palermo. Forty days ago he suffered from an acute pulmonary affection which lasted about 22 days. After a week of apparent good health he noticed a gradual rise of temperature up to 38-39 degrees C., recurrent in character, cough and fetid, sanguine expectoration appearing from time to time in the character of emesis.

Physical examination shows a well nourished patient with a symmetrical, cylindro-conical thorax, with the left side expanding slower and less than the right. On palpation vocal fremitus is normal throughout the pulmonary region, except that in an extensive area of the posterior surface of the left chest from the scapular angle to the base it appeared suppressed. In the same area the percussion sound is hypophonic. Auscultation revealed numerous rales and various rhonchi over the left chest during expiration. The sputum is abundant (90 to 120 ccm. per day), of yellow-greenish color, purulent, fetid, but showing neither spirochetes, tubercle bacilli nor elastic fibers.

Radiologic examination shows an area occupying the base of the left chest of homogeneous density whose regular margins are gradually fusing with normal pulmonary tissue. Near the costo-diaphragmatic recess of the same side one notes the presence of a small quantity of fluid.

Diagnosis: Postpneumonic abscess of the left, inferior pulmonary lobe.

Treatment with short wave diathermy in this case was started promptly, with daily seances of 15 minutes for the first two, and of 20 minutes for the subsequent days.

The patient complained of getting worse, his cough and expectoration increased, he became restless and at times delirious, the fever rose to 40 degrees C., but the objective findings manifested no change. After the 7th application the patient became violently agitated, left the clinic and refused treatment.

After about 40 days he returned stating that shortly after his departure

from the clinic the symptoms had abated and eventually disappeared. At this time he complained of moderate cough with scanty mucous expectoration without fœtor. On physical examination we noted that the dullness at the base of the left chest had been lessened, as did the previous harsh breathing, with but few rales (rhonchi) in that same region.

Radiological examination showed a noticeable reduction of the opacity seen at the first examination and the disappearance of the pleural effusion.

In another examination made two months later the patient no longer had any complaints and the physical examination revealed no pathologic evidence, if we except a slight harshness of the pleximetric tone at the base of the posterior left chest from the 8th to the 10th ribs at the scapular line.

CASE 6. — Francesco, C., 32 years old, laborer from Palermo. Five months ago he suddenly experienced pain in the right chest, cough with mucopurulent, fetid, sanguinous expectoration, fever (37.5-38.0 degrees C.). Fifteen days after the onset the symptoms became aggravated and he vomited up about 400 ccm. of thick, sanguinous, fetid liquid. After this the patient improved somewhat but for the past month the symptoms have been getting worse.

Physical examination reveals a symmetric, cylindro-conical chest of the costo-diaphragmatic type with inadequate respiratory excursions, particularly at the base of the right side. Vocal fremitus is slightly accentuated in the right subscapular region. On percussion there is marked dullness in the right subspinous and interscapulo-vertebral regions, from the 6th to the 9th costal interspaces. In this region the breathing sounds are harsh with small and medium rhonchi on expiration. Frequent examinations at various times showed repeated variations in the percussion sounds, which sometimes were exquisitely tympanic, while the respiration assumed an amphoric character.

Abundant fetid, sanguinous expectoration (100-140 ccm.) showed microscopically rare elastic fibers and absence of tubercle bacilli and spirochetes.

Radiologic examination showed at the inferior right lobe of the lung an area of opacity with irregular, blurred environment containing numerous nodules of the size of about a ten-cent piece, at the base of which is an area with a surrounding rete of the size of a small hen's egg. The costo-diaphragmatic space of the same lobe appeared obscured by a moderate effusion.

Diagnosis: Gangrenous abscess of the affected lung in the inferior right lobe.

Treatment was initiated with a seance of 5 minutes, followed by an application of 15 minutes and by two treatments of 20 minutes duration. After the fifth seance the patient was suddenly stricken with a violent pulmonary hemorrhage and expired.

It is difficult to establish if and to what extent the short wave therapy had any relation to the hemoptysis. Debating on the assumption of such an influence, we base it on the theory of vasodilatation and hyperemia. On the other hand it is essential to point out that the clinical history showed a disposition on the part of the patient to hemoptysis. At any rate this case conveys the lesson that in patients with a tendency towards pulmonary hemorrhage short wave therapy should be administered with especial care.

CASE 7. — Giuseppe, M., 62 years old, engineer of Palermo, has been a sufferer from grave diabetes mellitus for 5 years, with a glycosuria of 50-60 per cent and a glycenia of 3-3.5 per cent, for which for the past two years he was treated with insulin. Eight months ago he had pneumonia. Soon after an apparent recovery he began to complain of cough with an abundant, mucopurulent, sanguinous expectoration which in a short time became fetid. He had fever of the remittent type and pain in the right chest. He has sustained three attacks of vomiting, of 400 ccm. liquid each time. He came under our observation during his course of insulin therapy (100 units daily) and the intravenous administration of neosalvarsan.

Physical examination showed the patient to be greatly undernourished with a symmetric, cylindro-conical chest, with rapid costo-abdominal respirations (32 per minute). The right side of the thorax expands less and retardedly especially at its base, where vocal fremitus appears slightly lessened, resistance is increased with slight pain. Percussion of the same region at the 7th rib at the base and midaxillary line yields a hypophonic tone, while auscultation reveals various rales, sometimes gurgling in

sound, on both in- and expiration. There is abundant mucopurulent, sanguinous sputum (90-100 ccm. per day) fetid in odor, but devoid of elastic fibers, tubercle bacilli and of spirochetes.

Radiologic examination (fig. 5) shows the presence of a cavity of the inferior lobe of the right lung, the size of a hen's egg, partially filled with an effusion which moves during lateral movements of the patient, and moderate pleural effusion at the costo-diaphragmatic recess of the same side.

Diagnosis: Gangrenous abscess of the inferior lobe of the right lung. Diabetes mellitus.

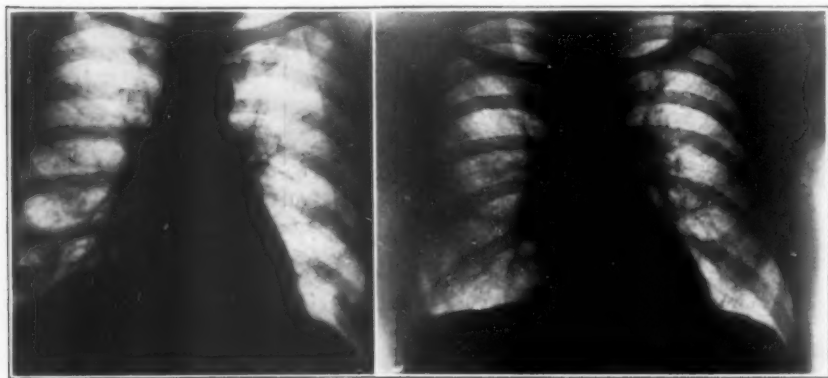


Fig. 5

Fig. 6

Fig. 5. — Shows the presence of a cavity of the inferior lobe of the right lung, the size of a hen's egg, partially filled with an effusion which moves during lateral movements of the patient, and moderate effusion at the costo-diaphragmatic recess of the same side. Fig. 6. — Examination made after the twenty-second application disclosed a decided reduction of the abscess cavity and absence of exudate. There is some evidence of adhesive pleuritis at the base of the right chest and at the right diaphragm.

As is apparent from the above data, we have to deal with a patient in a systemically grave condition, whose age and disturbed metabolism render the prognosis doubtful. Treatment with short wave diathermy was begun at once, in combination with the insulin-salvarsan-dietetic regimen for the control of his metabolic disturbance. The presence of hemoptysis and the lesson gained from the experience with the patient described as case 6, induced us to exercise great care in the administration of the short wave. The first two applications were given for 5 minutes each, the third and fourth treatments lasted 10 minutes each, the fifth 15 minutes, after which the patient was allowed a rest of two days. Later he was given two applications of 15 minutes each, which were followed by 19 applications of 20 minutes' duration. No harmful effects were seen, improvement taking place rapidly and satisfactorily.

The fever disappeared after the very first application. The expectoration became increased during a brief initial period, but gradually became reduced, losing its fetidity and assuming a mucous character. All the other symptoms improved correspondingly, so that the patient who before was unable to stand up, could in a comparatively short time continue his treatments while pursuing his vocation. Indeed, the physical examination at the conclusion of the course showed no pathologic lesion of the chest, except a lowered (hypophonic) tone at the base of the right chest.

The radiologic examination (fig. 6) made after the twenty-second application disclosed a decided reduction of the abscess cavity and absence of exudate. There is some evidence of adhesive pleuritis at the base of the right chest and at the right diaphragm.

It should not be overlooked that this patient was also given salvarsan, which renders it possible that the combination therapy may have hastened the regression of the lesion. Further research in this direction is necessary

to enable us properly to evaluate the advantages, if any, to be gained from this practice of combined therapy.

CASE 8. — Guiseppe, L., 37 years old, iron worker from Agrigento. The original trouble began about seven months before his consultation in our clinic, and was characterized by pain in the left shoulder, fever (38 degrees C.), mucopurulent expectoration, which shortly after became abundant and fetid. He had been given neosalvarsan from which he derived only temporary benefit.

Physical examination showed a symmetrical cylindro-conical chest, rapid respiration, hemithoracic asymmetry with a slight expansion of the upper third of the left chest. Slight pain of the Valldix costal points at the 2nd, 3rd and 4th intercostal spaces with strongly diminished vocal fremitus above the subclavicular, upper and left sub-spinous regions. There, especially anteriorly, the percussion tone is clearly hypophonic, while on auscultation is heard rough breathing, accompanied by various rales during in- and expiration. There is abundant sputum (100-200 ccm.), fetid and of a yellow-greenish color, which on microscopic examination shows no elastic fibers, tubercle bacilli nor spirochetes.

Radiologic examination showed an irregular opacity occupying almost the entire superior left lobe, superior cleft, and density of the superior horn of the hilus on the same side.

Diagnosis: Gangrenous abscess of the left superior lobe.

Treatment with short wave diathermy was initiated with the usual technique. At the fourth seance it was interrupted owing to the sudden appearance of hemoptysis. The therapy was gradually resumed, at which time the sputum lost every trace of blood, was continued for a month, during which 18 applications divided into two periods were administered without any untoward incident. At the conclusion of this course the patient was apparently cured and left the clinic.

In this case, too the quantity of the expectoration became increased during the first phase of the treatment (250 ccm. per day), became diminished successively and assumed a prevalently mucous character without any fetor. The fever also underwent a slight rise in the beginning, but disappeared gradually. Objectively there was disappearance of the moist state, while on the other hand the other signs remained unchanged.

Radiologic examination made shortly before the patient's discharge showed an infiltrative process affecting the superior left lobe, attenuation of the opacity at the cleft and of the infiltration lateral of the hilus, with pleural reaction limited to the left superior lobe.

CASE 9. — Giacomo, P., 33 years old, cabinet maker from Palermo. He had suffered for a number of years apparently from respiratory disturbances, manifested by cough with moderate mucopurulent expectoration, with occasional fever. Eight months ago he had bronchopneumonia, which was followed by an aggravation of the symptoms. In this last period the expectoration became markedly increased and appeared on occasion as vomitus of about 500 to 600 ccm. of sanguinous, fetid liquid.

Physical examination showed a symmetric, cylindro-conical chest with slight reduction of expansion of the left, as compared with that of the right side. Palpation caused moderate pain at the left thoracic base, where vocal fremitus was reduced. Percussion gave a lowered tone over the left chest, especially at the base. Auscultation revealed numerous rales of varying character over the entire left chest, more so at the base, where the rales sometime assumed a sonorous character. Over the right chest one heard a fine rale and some sibilating ones. There is an abundant, intensely fetid, blood-streaked sputum (about 200 ccm. per day).

Radiologic investigation shows diffuse infiltration with evident pleural reaction at the left chest. In the region of the hilus is noted a round cavity of the size of a 25-cent piece, containing fluid.

Diagnosis: Infiltrative process of bronchiectatic origin, diffuse at the left lung. Abscess cavity of the region of the hilus on the affected side.

Treatment with short wave diathermy was initiated with great care, medium applications of short duration (5-10 minutes) being administered. The immediate effect was not satisfactory, the symptoms becoming worse and the patient vomiting 1,000 ccm. of liquid.

The therapy was suspended and resumed cautiously a week later. During this second period of treatment the symptoms began to improve. This improvement, however, was gradually lost nor were we able to obtain any benefit from the treatment which was extended over two months.

The patient then left the clinic, but was readmitted 20 days later in a very serious condition, for which reason it was deemed inadvisable to give further treatment. The patient died a few days after his readmission.

CASE 10. — Francesco, N., 41 years old, groom from Palermo. A month and a half ago he had right lobar pneumonia for about 15 days. Eight days after apparent recovery he suffered from fever of a remittent type, cough with abundant expectoration, and pain in the right side of the chest.

Physical examination revealed a cylindrical chest with asymmetric expansion of the right side, especially at the base. Vocal fremitus is diminished posteriorly at the angle of the scapula and at the bottom of the left interscapulo-vertebral fossa. The percussion note is markedly dull at the base of the right chest and hypophonic in the subspinous and interscapulo-vertebral regions of the same side. Auscultation reveals various rales with diffuse gurgling sounds heard over the inferior half of the right chest. Abundant expectoration (200-250 ccm.) extremely fetid and of greenish color.

Radiologic examination shows a large opacity situated in the middle part of the right chest, decreasing in density above and becoming fused with the pulmonary transparency. There is some effusion at the base of the right chest (fig. 7).

Diagnosis: Metapneumonic pulmonary abscess, having presumably a point of departure at the inferior interlobar fissure.



Fig. 7

Fig. 8

Fig. 7. — Presence of a large opacity situated in the middle part of the right chest, decreasing in density above and becoming fused with the pulmonary transparency. There is some effusion at the base of the right chest. Fig. 8. — Examination at the end of the course disclosed the almost complete disappearance of the large opacity, which, in fact, was limited as a small streak corresponding to the inferior interlobar fissure.

Short wave diathermy was started carefully with a series of 6 applications averaging about 15 minutes. During this period the patient had an intense exacerbation of all symptoms. The temperature rose to 40 degrees C. and the expectoration became increased to a marked extent, appearing in the form of vomitus. There was no hemoptysis. The therapy was continued after about a day's rest with periods of 6-7 applications each, for almost two months. During this time the patient improved progressively and made a complete clinical recovery.

Radiologic examination at the end of the course disclosed the almost complete disappearance of the large opacity, which, in fact, was limited as a small streak corresponding to the inferior interlobar fissure (fig. 8).

CASE 11. — Giuseppina, G., 17 years old, housewife from Castellamare. Six months before presenting herself she was suddenly stricken by chills, which was

followed by stabbing pain at the base of the right chest, cough with scant expectoration, at first mucous then mucopurulent and finally fetid in character. From then on the symptoms increased with periods of rises and slight remissions continuing without change. There was no vomitus, but the sputum has at times been streaked with blood.

Physical examination showed the patient to be undernourished and in a bad general condition. The chest revealed oblique breathing through the lessened and delayed expansion of the right chest. Vocal fremitus is diminished at the inferior half of the right chest. In this area the pleximetric tone is markedly hypophonic, and on auscultation are heard numerous rales of medium and large rhonchi. Expectoration is abundant (about 100-150 ccm. per day), mucopurulent, occasionally also sanguine, very fetid. Microscopic examination shows numerous elastic fibers, but no tubercle bacilli nor spirochetes.

Radiologic examination discloses the presence of a large abscess cavity, filled with exudate at the base of the right chest, and evidence of exudative pleuritis at the base of the same side (fig. 9).

Diagnosis: Gangrenous abscess of the inferior half of the right lung.

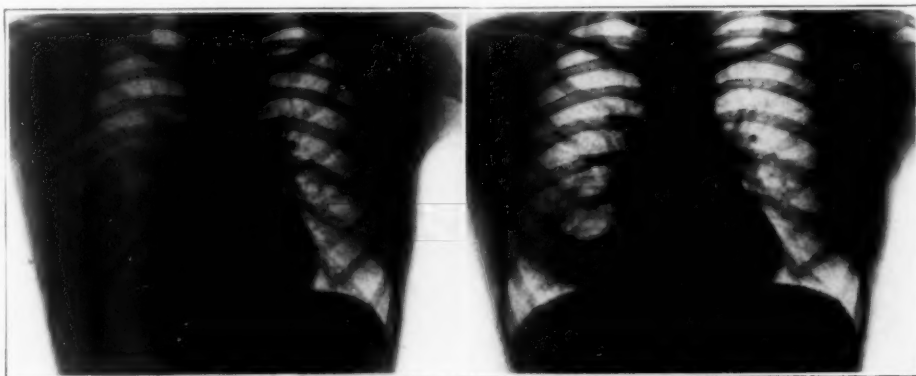


Fig. 9

Fig. 10

Fig. 9. — Discloses the presence of a large abscess cavity, filled with exudate at the base of the right chest, and evidence of exudative pleuritis at the base of the same side. Fig. 10. — Radiologic investigation demonstrates the complete disappearance of the abscess cavity and of the pleural effusion, showing merely the presence of a discrete perifocal reaction.

The grave condition of the patient and her tendency to hemoptysis caused us to employ mild therapy. The first applications of the short wave were tried out for only 5 minutes each. By this method the symptoms became worse, there being a rise of the temperature and an increase of the quantity of the sputum, which compelled us to desist after the sixth application. Later, however, when the symptoms ceased to become worse, the therapy was resumed with success. We always followed a prudent course of treatment with very small doses and took care to suspend the applications whenever the symptoms appeared to recur. After about 16 applications the patient showed decided signs of improvement, the fever became diminished, the expectoration lost its fetor and became mucous in character.

Objectively the pleximetric tone at the base of the left chest had assumed a tympanic character, and auscultation revealed plainly amphoric suifles. The moist state became markedly reduced.

Treatment was continued with larger doses (20 minutes) extended over 20 additional seances. At the end of the course the patient no longer complained except about a slight mucous expectoration without the least fetor (10-15 ccm. per day), and a slight pain at the base of the right chest. Examination revealed only a moderate reduction of resonance at the inferior half of the left chest, and slight pleural friction at the base of the affected side.

Radiologic investigation disclosed the complete disappearance of the abscess cavity and of the pleural effusion, showing merely the presence of a discrete perifocal reaction (fig. 10).

CASE 12. — Gaetano, B., 60 years old, fireman from Palermo, was suddenly stricken with a high fever 5 months before consultation. At that time he also suffered from pain in the right chest, cough with mucopurulent expectoration which soon became fetid. After neosalvarsan treatment the patient improved. Two months later he sustained a sudden attack of hemoptysis, the symptoms just mentioned reappeared and continued to get worse.

Physical examination showed a cylindro-conical chest, oblique respiration due to lessened and delayed expansion of the right chest. There was a large hypophonetic area with a tympanitic tone between the base and the angle of the scapulae from the posterior axillary to the paravertebral lines. In this area vocal fremitus is slightly increased. On auscultation one hears a number of large rales with medium and small rhonchi, discretely consonant with in- and expiration.

There is expectoration of about 100 to 150 ccm. per day, purulent, greenish, fetid, microscopic examination of which reveals neither elastic fibers, tubercle bacilli nor spirochetes.

Radiologic examination showed a large opacity in the middle part of the right chest with irregular margins blurred and unevenly fused with normal pulmonary parenchyma; moderate pleural effusion corresponding to the costo-diaphragmatic recess.

Diagnosis: Pulmonary abscess of the right inferior lobe.

Short wave diathermy was begun as usual, but increase in dosage caused vomitus after the third application (about 500 ccm. of liquid). After this occurrence the symptoms began slowly to recede, and after 30 sances the patient no longer complained but continued to emit a moderate amount of odorless sputum.

The objective findings revealed only slight lessening of resonance corresponding to a circumscribed area between the angle of the scapula and the base of the left chest.

Radiologic examination showed the opacity greatly reduced in size and density and the pleural effusion wholly removed.

Discussion

Study of the above cited cases clearly shows the efficacy of short wave therapy of pulmonary abscesses. Of 12 cases only two were not favorably influenced. In regard to these, it should be noted that one (case 6) is ascribable to an incident (hemoptysis) before the treatment reached the minimum number of applications to justify evaluation of it as a therapeutic agent. At any rate it is proper to list observations as failures when it cannot be definitely shown that the short wave has had no relation to the accident (vasodilating action of the wave).

The cautious treatment carried out by us in the other cases with a tendency to hemoptysis has proved adequate to prevent similar accidents, and thus to negate the hypothesis that short wave diathermy tends to cause hemorrhage. It has been demonstrated that any such effect can be duly corrected by the initial administration of weak doses administered over a longer period.

The failure experienced in case 9 can be explained by the nature of the distribution of the suppurative process. As has been alluded to, it was of bronchiectatic origin and affected virtually the entire lung. The diffuse pathologic process did not permit our applications to include the entire lesion, so that part of it escaped treatment.

One important item seems to possess a pathogenic influence on the lesion. Examination of the cases under consideration discloses that metaphneumonic abscesses are the most sensitive to short wave therapy, while

those of bronchiectatic origin are the most resistant to it. For that reason it is proper to report here that in three cases of bronchiectasis without abscess treated by us with the short wave, the results were merely a slight and temporary benefit.

Grave conditions have not been reported except those referred to in case 6. In practically all cases it was readily seen that the symptoms became aggravated at the beginning of treatment, sometimes with sufficient intensity to necessitate temporary suspension of treatment. In some cases (2, 10, 12) the appearance of vomitus marked the beginning of symptomatic improvement. Of the diverse symptoms pain, as a general rule, is the first to disappear. Fever at first becomes worse, then intermittent, and finally decreases to total disappearance. Expectoration is the most persistent phenomenon, at first losing its fetor, then the purulence, and finally remaining as sero-mucous sputum for some time.

As regards technic, we believe from our observations that if a pulmonary affection is to be cured, strong dosage is essential. This concept is successfully carried out in practice by Schliephake and Liebesny. It is not improbable that the failures reported by some authors are due to inadequate dosage. On the other hand it appears necessary to caution practitioners that in order to avoid an accident, such as the sudden appearance of hemoptysis, or an intensified recurrence of symptoms, treatment should be initiated with great care and with small dosage, when this form of therapy is administered as a last resort.

From an analysis of various pulmonary abscesses subjected to short wave diathermy, we cannot subscribe to the hypothesis of specificity of a wave in a bacteriological sense. It has in fact been established that metaphneumonic abscesses are the most sensitive to this treatment, and that in the majority of the cases the appearance of fetor is the first sign that characterizes a modification of the sputum (is this a specific action on the diplococci and on the bacteria of putrefaction?). Accordingly the findings do not appear to justify confirmation of a specific action of the short wave in the determination of bacterial form, especially if we take into consideration the multiplicity of the etiologic factors in every pulmonary abscess. It appears more probable that the beneficial effect of short wave diathermy on pulmonary abscesses is ascribable to the anatomic structure and function of the lungs, which, according to Schliephake, present a special suitability to this kind of treatment, as compared with other structures of the human system. The alveolar structure of the lung through which the energy is radiated presents a lessened resistance, while the pulmonary ventilation and the rich vascular net prevent undue concentration of energy in the form of heat. These characteristics facilitate the application of relatively intense doses to a normal lung, but this would prove of little value for the control of a lesion with its break in the continuity of the spongy tissue and reduced blood supply. Naturally any such lesion would present intense reaction to a large dose. Pulmonary tissue proper would obtain a beneficial effect from stronger doses of short wave diathermy, an agent which may be regarded as elective in effect on the lesion, without at the same time producing lasting damage to the normal structures.

On the basis of the studies brought to light by Schliephake, we might find an explanation for the favorable results obtained in pulmonary suppuration. Analyzing the problem from this point of view, it would seem more appropriate to speak of a specificity inherent in tissues.

(Concluded on page 102)

CANCER THERAPY BY ELECTROSURGERY AND RADIUM *

IRA I. KAPLAN, B.Sc., M.D.

Director, Division of Cancer, Department of Hospitals, New York City

NEW YORK

Irradiation has proved of distinct value in the treatment of malignancy. In some instances it is the only means of controlling the disease; in others it is definitely a retarding agent. In numerous cases surgical procedures are necessary before irradiation can be effectively employed, but in many others surgery can best be utilized only after effective irradiation has controlled the local condition or reduced it to such an extent as to render surgical procedure feasible.

The choice of surgical methods depends upon various factors, the most important being those associated with the type and kind of lesion, its extent, its condition and relation to other organs. While the classic method of surgery is applicable to most operable lesions, in some conditions electrosurgery offers a safer and more suitable method. This holds particularly good for malignant lesions, especially where the tumor mass is of the fungating, infectious and extremely vascular type. In these cases electrosurgery produces a more radical destruction and removal than is attainable by classic surgery. Bipolar coagulation prevents dissemination of infection and spread of emboli, besides controlling hemorrhage to a large extent.

While as yet there has been presented no definite proof that electrosurgery seals blood vessels and prevents the entrance of malignant emboli, clinically one has numerous examples that such a sequence follows this method of surgery.

One disadvantage associated with this type of surgery is the necrosis, however slight, that often precludes wound healing without infection. Nevertheless, all these factors must needs be ignored when one is confronted with a massive, friable, vascular lesion which impedes radium application. A tumor mass might readily be removed by the scalpel, but in such a case suturing would be impossible, because of the friability and vascularity of the tissues. It is precisely under such conditions that electrocoagulation is the appropriate procedure, and should be the method of choice because it obviates ligatures and suturing.

In lesions of the skin where the malignant growth is excessively large and markedly ulcerated, we have found it advantageous first to remove the bulk of the tumor and then apply radium or x-ray. Bulky tumors of the face blocking vision or the nostrils, may be removed either wholly or in part electrosurgically without hemorrhage and then treated by irradiation.

Small papillary growths may be removed in toto and keratotic, precancerous lesions of the skin destroyed in situ by fulguration or coagulation. This procedure often prevents subsequent malignant development. Melanotic lesions may be safely excised by electrosurgery, cutting widely around and deeply under the lesion. Subsequently radium may be applied directly over the wound to prevent recurrence.

Persistent refractile rodent ulcers, where radium therapy has failed, may be destroyed and the lesion controlled by endothermy.

Small lesions of the lip may be destroyed following biopsy and then

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 10, 1936.



Fig. 1

Fig. 2

Fig. 1.—Carcinoma of face, April 29, 1932, before electrosurgery. Fig. 2.—Carcinoma of face, one year after treatment (April 4, 1933), with endothermic removal and 2,600 millicurie hours of radon.

treated with radium. Large, bulky lip growths may be removed to a considerable extent by endothermy before radium treatment is carried out.

In oral lesions, large, foul or bulky ulcerations may be destroyed or removed by endothermy before radium treatment. Large tumor masses replacing the palate are readily removed by endothermic surgery and the bed treated by irradiation.

Large tongue lesions and malignant tonsillar growths are first removed, without hemorrhage, by endothermy after which irradiation is administered. Following radium therapy of such lesions there frequently may occur ulcerating persistent fibrous scarring and necrosis which may be more or less painful and interfere with normal function. In such cases we have found the surgical high frequency current of distinct aid in clearing up the condition. Coagulation following irradiation often prevents hemorrhage from ulcerated lesions further broken down by radium reaction.

In malignant lesions of the antrum the involved area is first resected electrosurgically, in some cases the overlying involved palate also being removed. Following resection, radium is placed in the resulting cavity and left in place the required time to deliver the planned dose.

Large, seemingly inoperable ulcerated breast tumors may safely be removed by the electric knife, the defect on the chest wall subsequently covered by skin grafts and x-ray therapy later administered for treatment of the remaining malignant conditions.

We have found endothermy of excellent value in the removal of vulvar lesions, both benign and malignant. For removal of the bulky ulcerated granulation growths of granuloma inguinale it is quite effective preceding x-ray therapy and helps control or cure the lesion. Ulcerated malignant vulvar or vaginal lesions are readily removed by electrosurgery.

In cancer of the cervix we often encounter cases where a large tumor growth fills the vaginal cavity and blocks entrance to the uterine canal. In such instances we have found it necessary to first remove the bulk of the tumor mass, in order to be able to insert the radium applicators used in treating the cancer lesion. Here the electric knife is an excellent adjunct because it cauterizes, coagulates and controls hemorrhage as it cuts away the malignant tissue.



Fig. 3

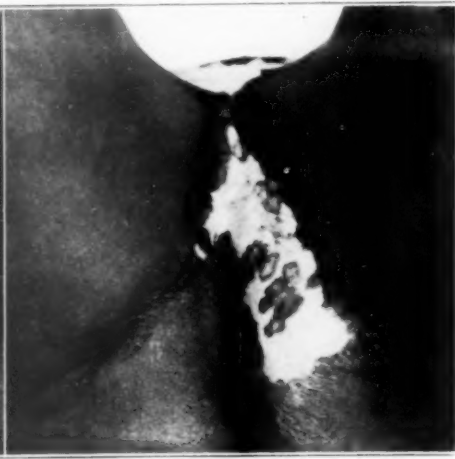


Fig. 4

Fig. 3. — Granuloma Inguinale (July 18, 1932), before treatment with x-ray and endothermy but after long and unsuccessful treatment with tartar emetic. Fig. 4. — Granuloma Inguinale; Vulva healed, four years after treatment by endothermy and x-ray therapy, the latter consisting of 1,400 r to Vulva and 1,600 r to suprapubic area.



Fig. 5



Fig. 6

Fig. 5. — Ano-rectal tumor (Sept. 27, 1934), before treatment. Fig. 6. — Ano-rectal tumor (Jan. 14, 1936), fifteen months after treatment with electrosurgery and x-ray therapy.

In our hands endothermy has proved of value in the treatment of papillary tumors of the bladder to control bleeding and remove excessive malignant growths before radium therapy is applied. It is also used with good results to remove in part or entirely the bulk of the tumor growth in cancer of the penis before or after radium therapy.

In rectal lesions, large neoplasms may be removed in part and small lesions completely eradicated by electrosurgery. Often we have found that by removing tumor tissue blocking the rectal canal, a previously closed channel can be opened sufficiently wide to permit proper insertion of the radium applicator. A narrow canal through which the rectal radium applicator can not be pushed can be coned out by the electrotome to permit the ready insertion of the radium proctostat.

55 East 86th St.

(For discussions of this and the following paper, please turn to page 97.)

ELECTROENDOTHERMY IN COMBINED TREATMENT OF TUMORS

ISABEL M. SCHARNAGEL, M.D.

Strang Memorial Clinic, New York Infirmary

NEW YORK

The methods used in the treatment of neoplastic diseases have progressed tremendously in the twentieth century. The recognized ones of today include surgery, the Roentgen ray and radium. Relative evaluation of these methods would be absurd because the best results are obtained by combinations of two or more. The surgical treatment was, of course, the earliest to be used by many years. Surgical procedures have changed decidedly, however, electroendothermy representing a great improvement in technic.

Cancer of the antrum and ethmoid cells has been treated by a combination of electrocoagulation and radiation for a number of years. Preoperative x-radiation is used in some clinics, followed by thorough eradication of the tumor and diseased bone with the coagulating current. The recent trend, however, has been to avoid any surgical procedure for cancer of the nasal accessory sinuses. The lesions are now treated with huge doses of external irradiation through small skin portals very accurately centered.

Electrosurgery is applicable only occasionally for gynecological cases. It is used widely and deservedly for cervical biopsies. For benign cervical erosion it is, of course, the treatment of choice. Some selected cases with borderline lesions of the cervix, the so-called precancerous lesions, may be destroyed by the coagulating current, thus avoiding sterilization of the patient with its distressing consequences in young women. Electrocoagulation of carcinoma of the vulva is practiced abroad with apparently good results and, we believe could be used more frequently combined with radiation therapy than surgery with the scalpel.

In radical mastectomy electrosurgery seems to offer few advantages to compensate for the added difficulty in technic since, in the better clinics, the patients rarely develop recurrences at the primary operative site. With this technic we have had no experience at the Strang Clinic.

Benign skin tumors may be excised with the cutting current or destroyed by desiccation. Papillomas of the skin benign in character, usually pedunculated, are quickly excised electrosurgically and do not recur. Papillomas of mucous membrane of the mouth, nose and larynx may be treated similarly. Individual lesions of von Recklinghausen's disease, which are annoying because of their location, may also be excised with the cutting current. Bleeding at the base is quickly stopped by coagulation. Sessile papillomas and verrucae may be desiccated, if they are not too large. When verrucae are over five millimeters in diameter it is more advantageous to radiate in a dose sufficient to raise the external layers of the skin, so that the lesions come away when desquamation occurs.

Epidermoid carcinoma or spindle cell carcinoma is a highly malignant skin tumor the growth of which is fairly rapid and extension to the regional lymph nodes takes place early. The choice of treatment must be decided individually. As a general rule, radiation in some form applied to the primary tumor will be followed by excision of any remnant, preferably by electroen-

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 10, 1936.

dothemy. The treatment of metastases in lymph nodes from epidermoid carcinoma will not be discussed in this paper.

Case Reports

CASE 1. — This papillary epidermoid carcinoma of the skin on the left wrist of a woman of 64 years had been present less than four months and measured $7 \times 5 \times 2\frac{1}{2}$ centimeters. The skin had been burned by hot grease four months before, and when this had practically healed a cat scratched the same area. The resulting infection was incised by a physician and treated a few weeks. The scarred center of the burn is seen in the present lesion. There were no palpable metastases in regional lymph nodes. It was excised with the cutting current under local anesthesia followed by skin grafting by Reverdin's method.

Basal cell carcinoma or rodent ulcer usually responds to radiation alone. Tumor remnants are excised electrosurgically only if the primary response is not satisfactory.

Nevus cell tumors form a large group of skin tumors. The vascular nevi or hemangiomas are of several types. The large lesions of the "port wine" type are usually so extensive that no treatment is advised since it would lead to some impairment of the skin in a large area. The so-called spider nevi, which have one central vein with radiating capillaries, disappear after desiccation of the central vein. Some small capillary hemangiomas may be treated by desiccation. In the Strang Clinic, however, we prefer radiation from a suitable radium applicator for capillary as well as cavernous hemangiomas. Excision with the scalpel is chosen in isolated cases where the cosmetic effect would be better. It must be wide enough to prevent recurrence.

The pigmented nevi are a much more serious problem. The differential diagnosis is not usually difficult if the history is carefully taken. There is a definite observation on the part of the patient in about half the cases that a long existing birthmark started to grow and changed in appearance. This change in appearance is usually obvious. We believe in prophylactic removal of all deeply pigmented nevi without hairs which are situated on the face or where they are subjected to trauma. Excision with the cutting current is preferred including one-half centimeter of the normal skin. Desiccation should never be considered for any pigmented lesion on the skin.

The treatment of malignant nevus cell tumors is excision with the cutting current including at least one centimeter of the normal appearing skin. We know that the malignant cells spread in the skin very rapidly, giving rise to tiny black nodules which seem to increase in size and number under our eyes.

After excision the wound is often left open to granulate in. Post-operative radiation is usually utilized. When operable metastases are present in the lymph nodes of the neck, axilla or groin, dissection of the region is usually not preceded by x-radiation. Prophylactic regional lymph node dissection is now practiced by Dr. Pack at Memorial Hospital at the same time that the primary lesion is excised.

CASE 2. — A man of 57 years had had a birthmark on the trunk all his life. Five months before his admission to the clinic he noticed a warty growth arising in the center which bled with slight trauma. A physician was consulted who used desiccation several times in the next month without results, so he removed the lesion surgically. In three weeks nodules appeared around the scar and shortly afterward in the scar itself. At the time of admission there were two hard axillary nodes with metastatic disease. Endothermic excision of the entire area on the trunk and left axillary dissection with postoperative x-radiation proved unsuccessful. The patient survived the treatment only thirteen months.

CASE 3. — This young woman of 28 years came to the Strang Clinic with a recurrent melanoma on the right shoulder which was 1.5 centimeters in diameter. It had been excised seven months before, less than a month after it was first noticed

by the patient. Recurrence occurred after 2 or 3 weeks. The patient was in the sixth month of pregnancy and wished to have the child very much. Wide excision of the recurrent tumor was done two days after admission. Labor was induced about two months later when the fetus was viable. An axillary metastasis was then palpable. Axillary dissection was unsuccessful though followed by heavy irradiation. Within four months pinpoint black nodules began to appear on the chest wall. As the disease progressed the entire skin became blue tinged owing to a diffuse melanosis. The patient lived 1 year and 7 months after admission. We wish to stress the point that no nevus cell tumor should be treated in any way except by complete excision, any other treatment being dangerous.

Summary

Tumors treated with electroendothermy at Strang Memorial Clinic are cited with a brief discussion.

A few cases of melanoma are presented. Endotherm excision with post-operative irradiation is the treatment preferred. Nevus cell tumors should not be treated except by complete excision.

310 E. 15th St.

Discussions of Drs. Kaplan's and Scharnagel's Papers

Dr. Grant E. Ward (Baltimore): As time goes on the medical profession will realize that he who is to solve the cancer problem or any tumor problem, whether benign or malignant, must have a reasonable knowledge of all forms of cancer therapy. It is no longer a problem of the surgeon or radiologist familiar with electrosurgery, but one must be cognizant of the values and indications of all methods of therapy and apply them selectedly to each case. The choice of any therapeutic agent depends upon two main elements: First, a biopsy should be made in every case where it can be reasonably well carried out. Those tumors which on microscopic examination show radiosensitivity should be treated by an appropriate form of irradiation. Those which are resistant to radiation, need a combination or choice of some non-radiation therapy. Many tumors are moderately sensitive, and sufficiently strong doses of x-ray or radium will greatly reduce the tumor and devitalize it so that surgical or electrosurgical removal will prove advantageous to complete the therapeutic regimen.

The second factor in the choice of a therapeutic agent is the site and extent of the tumor. Accessible tumors of the skin, oral cavity, sinuses, neck, bladder, and uterus are usually treated by combination therapy, if they are very extensive. Some of them are best removed first and then followed by radiation. As a rule in these large tumors we radiate them first to shrink and devitalize them, to render surgical removal easier and most often safer. By surgical removal, I mean removal with the scalpel or with electro-tome, as the case indicates.

Under the heading of location and extent, I would emphasize also the internal cancers which demand an entirely different approach, as a rule. These have not been discussed this morning. We know that most of the deaths from cancer are caused by malignancy of the gastrointes-

tinal tract, liver and lungs. We exclude cancer of the cervix and uterus from this group because it is regarded as accessible or external, its symptoms usually manifesting themselves externally.

The problem of internal cancer is largely one of surgical approach, either from the standpoint of diagnosis, biopsy or removal. With a definite diagnosis based on biopsy, radiation therapy is the method of choice in the vast majority of cases, except the truly operable group.

I should like to obtain information on the attitude of interested members of this organization towards the routine radiation of the lymphatic glands in the vicinity of any malignant growth. In our tumor clinic I have been urging the roentgenologists to routinely x-ray the neck in all cases of malignancy of the oral cavity. It seems to me that to wait until a palpable gland develops means a definite advance in the disease and a much greater problem. If one radiates routinely the glands of the neck, and there should be microscopic metastasis, it is much easier to radiate a few metastatic cells that are amenable to treatment, than after these become a palpable mass.

The question of the pigmented nevus is always one of interest. It has been one of interest before radiation or electrosurgery came into being, and wide surgical excision has always been emphasized since surgery has been applied to the cancer problem. In the removal of a pigmented mole it is not a question of method as of the thoroughness of the procedure. I think I am safe in saying I have destroyed electrosurgically thousands of pigmented and non-pigmented skin blemishes in the last thirteen years and recall only one that ever metastasized. That was a large one about one by one and one-half centimeters, on the back of an ear which had been treated with some form of light therapy for several months before I saw the individual. I removed it widely, I thought, by electrodissection,

not desiccation, and with a strong cutting current. I confess there was a local recurrence. I removed it again and in about six months I removed the glands with a wide margin, using electrodissection throughout the glands and desiccation of the neck. He had no local recurrence, but died of metastasis of his brain. That is not uncommon. Those who remove these pigmented tumors with the scalpel have the same experience. Whether the metastasis in this one case occurred before I removed it or after, no one knows.

A large melanotic tumor is best excised widely with a scalpel or electrosurgically. I prefer excision with a strong cutting current and sometimes I remove the coagulated edge of the skin with a scalpel in order to get better union and more rapid healing. Personally, I prefer electrosurgery in those cases because we do seal over the lymphatics and blood channels. Practically all recurrences of the melanomas that I have seen, have followed scalpel surgery by someone else.

I think the whole problem of metastasis and malignancy is still unsolved in melanoma as in other tumors. The emphasis should be placed upon the thoroughness of the procedure, because the growth penetrates deeply into the subcutaneous tissues. Unless all malignant tissue has been removed, a cure is not likely to take place.

Dr. Wm. H. Schmidt (Philadelphia): The important statement by both essayists is that properly to treat cancer one should be familiar with all methods and should use those which are indicated in each case.

Dr. Kaplan has used the surgical cutting current very frequently and always follows it by radiation. Unfortunately with electroexcision there is very little coagulation beyond the line of incision, necessitating additional treatment by radiation. If the well differentiated type tumors, such as basal cell epitheliomas are thoroughly destroyed by electrocoagulation, radiation is unnecessary because they very seldom metastasize, and any recurrence is local in character, which can be removed completely. That should, however, not occur, if a lesion has been treated radically.

I was especially interested in the discussion of melanoma because of the diversity of opinions held by authorities. It is my impression from a long experience that proper treatment of a non-malignant melanoma does not produce a malignancy. Unfortunately, patients frequently seek aid at a time when the lesion is irritated and already has undergone malignant change. Then, of course, operation is followed by recurrence conveying the impression of a result of the treatment. I believe if a melanoma is completely and thoroughly removed, it will not cause any trouble. The danger of causing malignancy is very small, if the neoplasm is removed early and radically.

Dr. R. E. Brenneman (Meadville, Pa.): In treating malignant lesions we sometimes fail to realize the biologic effect of

irradiation. We are treating the disease locally. We, of course, attack new growth on the skin or wherever it may be. In the fight against cancer it is essential to measure or find out in some way the effect of radiation. Taking erysipelas as a criterion, I obtained satisfactory results from light doses of x-ray, in which the direction of the irradiation was not toward the lesion itself, but to any part of the body. For several years I have directed irradiation along the spinal column, any place, and we got results. Something takes place in the protoplasm of the cell and we have the effect of irradiation on the system that is not local. I have also treated various skin lesions with the rays directed elsewhere to the body. That suggests a different concept of the effect of irradiation.

Dr. Tibor de Cholnoky (New York): I agree with Dr. Ward that electrosurgery gives a good result if a nevus is treated properly. In any cancer service lesions treated inadequately with electrosurgery metastasize and even pigmented nevi become malignant. Electrosurgery provides the irritant for degeneration when these lesions are treated only superficially. Therefore, it must be emphasized that the whole lesion should be widely excised or coagulated and the surrounding tissue removed. In the New York Postgraduate Hospital malignant degeneration is treated by excision and regional lymph node dissection. It seems to us this way our results are far better and our five-year cures are more substantiated.

As to electrocoagulation we found it indicated in tumors which are ulcerated and infected. Electrocoagulation is an entirely different procedure from the ordinary conception of surgery. Surgery aims to remove the whole tumor in one block, without cutting through the tumor tissue proper. By coagulation we eradicate the tumor through its extent step by step to render that field properly adequate for irradiation. It is possible after electrosurgical destruction and cleaning of the wound, to cover this infected area by skin flap and plastic surgery, as I demonstrated in one of my recently published articles.

Dr. Scharnagel (closing): We do not use prophylactic x-ray therapy for regional lymph nodes where metastasis has not occurred, because we think we injure the skin in that way. If metastasis should occur, injury to the skin will interfere with proper treatment, and we therefore, prefer to wait until metastasis is evident before any treatment is given to regional lymph nodes.

I should like to make one remark about melanomas. We are all familiar with Dr. Ewing's statement in his book about melanomas, in which he mentions that there is a very marked variation in clinical course. I remember one woman I saw in Stockholm, who had been treated for malignant tumor which was histologically no different from other melanomas. About twenty years before she had been

taken to Edinburgh to be treated with one of the first x-ray machines. The local lesion disappeared. It recurred. She had had multiple recurrences in twenty years. Some of them were destroyed with radiation alone, some were excised. The patient never developed metastasis and that is the usual course in some of these tumors.

Dr. Kaplan (closing): Dr. Ward made a worth while assertion when he stated that in the treatment of malignant conditions, it is less a question of surgery alone, electrosurgery or radiation, as of the thoroughness with which we attack the condition. It makes little difference whether one cuts a lesion out with a half-inch margin or a one-inch margin or a six-inch margin, for everything rests on the nature of the lesion and whether the proper method is used at the time the lesion is operated.

The remarks about internal organ therapy are very difficult to answer because we have not had any successful experience with electrosurgery in visceral malignancy.

The chairman mentioned I make use only of the cutting current. I do that advisedly, because we use endothermy, not as a satisfactory method for complete destruction of the lesion, but as an adjunct in the control of the various conditions encountered in our service. We do use coagulation, but in most instances employ electrosurgery merely to help us

control the lesion in connection with radiation.

Dr. Ward raised the question of the efficacy of lymphatic control. We believe that it is best to attempt control of the lymphatics before they are palpable, and for that reason in most of our conditions we use preoperative prophylactic irradiation.

Dr. Brenneman asked a very pertinent question and a very difficult one to answer. The biologic reaction of irradiation is something that has not yet been answered successfully. Do we have biologic action merely because of local action on cells? Do we have it because of some endocrine stimulation or inhibition? Do we have it because of some vascular changes, stimulation or inhibition of vascular changes? Do we have physiologic changes produced by some indirect method through bloodstream, through chemical disorganization or reorganization of catalytic action of x-rays?

All those problems have yet to be answered. We know, for instance, irradiation will stimulate amenorrheic women who are suffering from sterility and cause these women to menstruate normally and allow them to become pregnant and give birth to normal children. On the other hand, we know that we can take x-rays and inhibit all menstrual function and produce a definite castration of women so that childbirth becomes impossible. All that takes place and without any definite biologic explanation.

ELECTRICAL SHOCKS: CAUSES, INCIDENCE AND CONSEQUENCES *

DOUGLAS MACFARLAN, M.D.

PHILADELPHIA

The expanding uses to which electricity is being put, especially in the field of household appliances, has brought about not only a greater incidence of electrical shocks but has added another class of individuals exposed to these accidents. Formerly there was a relatively high rate of electrical injuries among linemen, power-house maintenance and telephone workers, but now these accidents are occurring also in domestic circles. This aspect justifies a renewed consideration of the problem.

The actual figure on the increase in deaths from electric shocks in the year 1934, as compared with 1933 is 6.5 per cent, although accidental deaths from all causes increased in this period 11 per cent. However, the trend for accidents in general has been downward over a twenty-year period. From 1913 to 1935 deaths from all accidents decreased from 45.7 to 21.9, and for electric shocks, 2.4 to 0.7 per 100,000.

There is no data available for electrical accidents other than those

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 9, 1936.

terminating fatally. It may be well to utilize the information already at hand, obtained from the fairly abundant literature. The collective evidence from case histories clears the atmosphere of many of the vagaries as to effects of electric shocks. The following may be accepted as facts:

1. Lightning and high tension currents are not the only dangers; serious and fatal injuries may be encountered from the apparently harmless house circuit.

2. Many of the effects of electric shocks are not immediately manifest, yet they may be serious. There is the commonly known muscle degeneration and atrophy from spinal cord damage following shock. This may not begin until weeks or months after the accident; the later its appearance, the more serious the condition. It is slow, progressive and intractable. This has been reported in shocks from house circuits where contacts have been ideal for the greatest transmission.

3. Neurosis and "nervous shock" are obtaining a more serious consideration than was heretofore given them. True, there is still the occasional malingerer, but more often than not these manifestations are actual symptoms, not feigned nor hysterical. Mental inertia and amnesia are commonly seen. The symptoms resemble war neuroses or post-encephalitis in the characteristic timidity, fear, uncertainty, lack of memory and inability to concentrate. True hysteria may complicate the picture, especially with sensory anesthetics and states of coma. One must not, however, be too ready to add a diagnosis of hysteria, for certain of the cases show an anesthesia undoubtedly based upon peripheral nerve damage or spinal cord injury. Careful testing of reflex arcs; care in neurological tests, and the discovery of a constancy of the anesthetic areas will at least admit of something more than hysteria.

Early Effects

As to the immediate effects of the shocks, one need be no more concerned about electric burns than one would be about burns of a similar degree from other causes. In fact, there is an opinion that electrical burns are more anesthetic, less painful and heal more quickly than others. An annoying, persistent initial symptom is muscular weakness which may continue for weeks. This must not be confused with the later appearing weakness of muscle atrophy. Such initial weakness may find its origin in the muscle tissue damage produced by the extreme contracture or clonus of the shock.

Another initial symptom of importance is, of course, the vagus block and asphyxia from a "stalled" heart. This gives the immediately fatal cases, and depends largely upon the item of points of contact (topical relations) of the current with the body. Contact of head or neck and left arm or left leg endangers the vagus or its centers. The arm to arm circuit is prone to produce lesions in the lower and middle cervical cord (C4-C8, occasionally 1st D.) (Panse). Foot to foot, or leg to leg affects degenerations in the lumbar and sacral segments, with late atrophies, and paresthesias, anaesthesias, or ataxias more rarely.

The fact that many of the victims of shock are forcibly hurled down and knocked unconscious must make one mindful of the possibility of cranial injuries, concussion, basal or spinal fracture. Such damage might easily be overlooked.

Mills and Weisenburg have shown that repeated minimum electric shocks predispose to neurologic sequelae. There is sufficient evidence that the telephone accidents may not be quite as harmless as is assumed. Electric shocks rather than acoustic "bangs in the ear" are referred to.

A frequent late finding is the production of cataract, although the reason for this is not clear.

Animal experimentation has done much to establish the fact that the type of current (A.C. or D.C.) is relatively unimportant, dosage, length of exposure and topical relations being prime considerations. High variation in tolerance is seen as an individual characteristic of animals as well as of humans.*

Returning to the consideration of the growing commonplaceness of electric shock, the statement will not be challenged that most men and many women are amateur electricians with decidedly insufficient knowledge about dangers and limits of safety. This is largely the result of readily available and inexpensive outlets, plugs, extension cords, armored wire and the like, which most people carelessly install. The result is at times comparable with that of the man who thinks that by buying his own medicine at the drug store, he can be his own doctor.

House circuits are commonly grounded "on one side" to comply with fire underwriter specifications. And here is the rub — for many household electrical appliances are designed with one side bare, just as are most of our diagnostic medical instruments. Few of us realize the danger until we are shocked into a consciousness of it. (To a patient being treated, the accident may be more than alarming.) The domestic hand iron and the electric curling iron are common offenders, and as both are apt to be used in the bathroom where ideal "wet" short-circuits can be made, the shocks received are frequently lethal. The invisibility of the danger makes the uninformed layman wholly oblivious of consequences.

As physicians using electricity, we have no excuse for shocking patients. Legally, we would stand little chance in damage suits. Everyone using electrotherapy knows this, but many other specialists and general practitioners do not. In our contacts with our fellows we must constantly warn them to insulate and to polarize their apparatus. We must, above all, warn them, and the public in general, that the house circuit is not always as harmless as it seems.

Case Histories

CASE 1. — A man aged forty is seated in a barber chair; the manicurist has the fingers of his right hand immersed in a metal basin attached to the arm of the metal chair. The barber begins to give him a facial massage with a hand vibrator the cord of which is wrapped around a water pipe. The patient is thrown out of the chair, unconscious, and suffers paralysis for over three years.

CASE 2. — An elderly man is in the bathtub with an inch or two of water in it, there is a wall outlet near — he reaches for a hand vibrator to plug in for a massage. He is found dead in the tub.

CASE 3. — A farmer is standing on a damp floor at a work bench in the barn, he plugs in a hand drill to bore a hole in a piece of metal. He is knocked unconscious.

CASE 4. — An old man, age 72 years, a former electrician, is repairing a hanging socket. In some way he contacts the radiator in the room at the same time. He is killed by the shock.

CASE 5. — A young lady is in the bathroom about to curl her hair with an electric curling iron. She reaches to turn on a spigot and is knocked across the room.

CASE 6. — A urologic surgeon is in the operating room with a patient on the table, and an assistant hands the surgeon an electrocautery. A shock stuns the surgeon.

CASE 7. — An otologist with an electric "specklight" on his forehead is putting a metal speculum into the ear of a patient, both patient and physician get a sizable shock. The patient was leaning against a metal cuspidor.

CASE 8. — A young girl is talking over the telephone. Repair men nearby are working on a high tension line, below which are strung the telephone wires. A piece of wire is dropped across the lines, there is a flash in the room and the girl

* This paper is not concerned with the effect of electric frequencies per se, but rather with commercial circuits.

is knocked to the floor. This has occurred in spite of lightning arresters on the 'phone line. There is a damage suit, a sympathetic jury, and a large verdict as a consequence.

These cases can be multiplied ad infinitum, they illustrate the casualness of the circumstances leading up to the accidents. They show that more care and respect must be given to our useful servant electricity.

1805 Chestnut Street.

Discussion

Dr. Richard Kovács (New York): Considering the widespread application of electricity for therapeutic purposes there is an almost negligible amount of injury caused by it. This is, in my opinion, rather due to the fact that most apparatus are of a safe and efficient type than to the fact that physicians using these apparatus have familiarized themselves with any possible dangers connected with their use. During the course of an electrical treatment or examination by an electrical device, shock may be caused either by an accidental contact with a grounded object or by transformer breakdown. In the first case an accidental contact with a water pipe, radiator, electric light socket offers a direct path to the ground circuit, giving the patient the full force of a 110-volt current. Fortunately shocks caused by such occurrences become serious only if a large surface of the body offers good conduction, such as an electric bath. In the second case, if a therapeutic current is derived from a high-tension transformer and during the treatment a breakdown of insulation occurs between the primary and the secondary side of the transformer, the high-tension, low-frequency current may jump over to the patient. Magnetic cut-outs and not fuses are the only preventive of this type of accident. Competent radio engineers tell us that in some of the flimsy short-wave apparatus assembled by concerns with no previous electromedical experi-

ence there is grave danger of electric shock due to the poor quality of the dielectric in the condenser.

So far as the general use of electric appliances in the household is concerned there are two general rules of precaution for everyone. The first is never to touch an electrical appliance while standing in water, on a damp floor, or while any portion of the hand or feet are wet; second, never handle two electrical fixtures at the same time. There is always the danger of a worn-out insulation in one apparatus and, by touching its metallic part while handling another apparatus, there is the chance of a leakage ground current to cause a sudden shock. The same precautions pertain to the use of therapeutic appliances. In using low frequency currents, there never should be an electrode over or near the heart, because even a small amount of current passing through the cardiac area may cause fibrillation of the heart and electric shock. This danger to the heart is the reason why, generally speaking, shocks from an alternating current are more dangerous than from a direct current source.

Dr. Macfarlan has pointed out the fact that electric shocks may have serious after-effects. Since most of us fortunately have had little direct experience with such effects, I would recommend to the study of those interested the classic volume of Jellinek of Vienna, the "Electric Injuries."

Short Wave Diathermy in Pulmonary Infections — Fiandaca

(Continued from page 91)

Bibliography

1. Fiandaca, Salvatore: Sulla terapia dell' ascesso pulmonare con le onde corte, *Riforma med.* 50:323 (March 3) 1934.
2. ———: Noma in convalescente di tifo; guarigione dopo applicazione di onde corte, *Riforma med.* 51:402 (March 16) 1935.
4. Hayer, E.: Klinische Erfahrungen mit der Kurzwellen-Therapie, *Münch. med. Riv. san. siciliana* 22:1564 (Oct. 15) 1934.
4. Hayer, E.: Klinische Erfahrungen mit der Kurzwellen-Therapie *Münch. med. Wehnschr.* 81:1467 (Sept. 21) 1934.
5. Liebesny, Paul: Kurz-und Ultrakurzwellen, Biologie und Therapie, Wien, Urban, 1935.
6. Krusen, Frank H.: Short Wave Diathermy; Preliminary Report, *J. A. M. A.* 104:1237 (April 6) 1935.
7. Schliephake, E.: Die Ultra-Kurzwellentherapie in der inneren Medizin, *Wien klin. Wehnschr.* 46:1217 (Oct. 13) 1933.
8. ———: Kurzwellentherapie. Jena, Fischer, 1932.

IONTOPHORESIS OF VARICOSE ULCERS *

JOSEPH KOVACS, M.D.

Instructor in Medicine, New York Post-Graduate Medical School and Hospital of Columbia University

NEW YORK

The treatment of varicose ulcers is still in an unsettled state. This is shown by the numerous procedures including vein obliteration, that have been recommended in the last decades. In spite of various procedures certain ulcers have failed to heal and the many patients so treated remained incapacitated for the rest of their lives. It is our purpose to present further evidence of a more satisfactory method of treatment applied to chronic ulcers associated with varicose veins or with occlusions following phlebitis of the deep veins than any hitherto reported.^{1,2}

The etiology of varicose ulcers is now generally accepted as a tropho-neurotic disturbance due to pathologic circulatory conditions. Varicose veins and weakened venous valves tend to produce a condition of stagnation of the venous blood flow. A back pressure is thus created in the capillaries so that the tissues become water-logged and edematous. Associated anoxemia and impaired nutrition and accumulation of toxic waste products further reduce the resistance of the affected area until the slightest injury, abrasion or infection suffices to create an ulcer. Deep phlebitis seems to produce an almost identical train of effects.

The actual ulceration begins with gangrene of the superficial layers of the skin, sometimes including destruction and sloughing of part of the external wall of the vein. The ulcers as a rule are irregular in shape and vary in size from a pinhead to that of a larger area. They can usually be differentiated from syphilitic ulcers, which are more clearly "punched out." The base of the ulcer is usually covered with necrotic tissue and is bathed in an abundance of seropurulent fluid.

Healing of the varicose ulcers can be expected only by increasing the peripheral circulation, improving the nutrition of the tissues and eliminating the local anoxemia. Most of the remedies used in the past, such as rest and elevation, elastic bandages, and the like, "Unna's Boot," injection of the varicose veins and ligation of the saphenous vein, were designed to effect such improvements.

Injection of vasodilating drugs, especially acetylcholine, has also been used with the same purpose in view.³ Believing that the local penetration of such vasodilating drugs might be even more effective in stimulating the circulation and healing the varicose ulcers, acetyl-beta-methylcholine chloride was introduced by the method of iontophoresis.

In this paper we present the cumulative record of our work with 54 cases, which include the nine reported before the Section on Pharmacy and Therapeutics of the American Medical Association,¹ and the 26 cases published in 1936.²

The patients were unselected for this study, and the following experimental conditions were maintained:

1. With three exceptions, our patients had been carried through a control period of observation, ranging from one to thirty-seven years, during which time many had received all accepted forms of treatment without success.

* Read at the Fifteenth Annual Session of the American Congress of Physical Therapy, New York City, September 8, 1936.

2. During the period of treatment no patients were hospitalized or put to bed, but were urged to continue their daily occupations, which ranged from heavy manual to routine office work.

3. No other form of treatment, such as injections, was used during the course of the iontophoresis. A plain petrolatum dressing was permitted during the early stages of the treatment, if it made the patient more comfortable. Veins, if indicated, were injected only after the ulcer had healed.

Technic of Treatment

A standard 0.5 per cent solution of acetyl-beta-methyl-choline chloride is used. Reinforced asbestos paper is saturated with the 0.5 per cent solution of the drug and wrapped around the foot and leg as high as the knee. The ulcerated area is not covered until it is healed or covered by a firm crust. After this has occurred, the application may be made directly over the healed area also. A malleable metal plate is placed over the wet asbestos paper and connected to the positive pole of a galvanic machine. The metal plates are never applied over the ulcerated area. A large, regular, moist pad electrode is used as a dispersive electrode. This is placed under the back and connected with the negative pole. The current is turned on and slowly increased to 20 or 30 milliamperes. At the end of the treatment the current is slowly reduced and turned off. Treatment is given in some cases daily, but generally two to three times weekly, from twenty to thirty minutes.

Local Reaction. — There is a characteristic local reaction, directly under the site of application of the drug. This consists of (1) a sensation of prickling followed by one of warmth during the treatment; (2) the appearance of goose-flesh immediately after removal of the asbestos paper; (3) a local blush of the skin; (4) sweating of the skin, which may continue from six to eight hours; (5) an elevation in surface temperature during treatment, followed by a drop during profuse sweating (with accompanying evaporation) and a rise above the former level in from one-half to five hours.

There are individual variations in reaction, as in the use of most drugs. Some individuals who scarcely react to the first treatment show an increasing reaction to subsequent ones.

General Reaction. — There is also a systemic reaction present which is an exact duplication of those following the subcutaneous or intravenous administration of the same drug. *This occurs practically always in very mild and prolonged form but is rarely noted following iontophoresis.*

A moderately severe systemic reaction resulting from the iontophoresis treatment might be characterized by (1) a marked flush, extending over the face, chest and upper part of the abdomen; (2) an increase in pulse rate; (3) a deeper, slower respiration cycle; (4) a marked drop in blood pressure; (5) definite salivation (in one instance as much as 140 cc. of saliva was collected in twenty minutes); (6) increased lacrimation; (7) profuse diaphoresis; (8) increased intestinal peristalsis with abdominal spasm and occasional, immediate defecation; (9) infrequent substernal pressure; (10) diuresis in certain individuals, to a varying degree; (11) changes in the electrocardiogram resulting in temporary inversion of the T waves in one or more leads; (12) slight cyanosis at the tips of the extremities with a drop in surface temperature, which usually rises above the original level in from one to six hours. If desired, immediately cessation of effects may be produced by the injection of atropine, 1/100 grain (0.00065 Gm.) subcutaneously.

Results

Fifty-four cases of chronic ulcer have been treated by this method. Of these there are 11 cases still under treatment. The detailed data are given

in the accompanying tables. Of the 43 completed cases only two did not show satisfactory results.

The first patient, M. A. (case 3) with an unsatisfactory result was that of a woman with a postpartum phlebitis and varicose ulcer of eight years' duration. She had been bedridden for seven months before we started treatment. The ulcer was healed after twenty-one treatments, but, when thyroid extract was given by the family physician in doses up to 4-6 grains (0.26-0.4 Gm.) a day, to help reduce the weight of the patient, the ulcer promptly recurred and could not be rehealed. The patient was over weight, although the basal metabolism was normal. We are unable to state definitely at this time the cause of the recurrence.

The second patient was S. E. (case 54) a man, aged 31, who had two large varicose ulcers of four years' duration on the left leg. One of these was a punched-out ulcer at the middle of the calf, 2.5 cm. in diameter, surrounded by a discolored, brawny, scaly, edematous area, 1.2 by 8 cm. in size, in which several small (pinhead sized) ulcers were present. These ulcers healed after twenty-four treatments and the surrounding area was much improved. The other ulcer was located over the internal malleolus. It was 4.5 by 2.25 cm. in size, punched out, and surrounded by an inflamed, edematous, indurated area of 10 by 5 cm. The ulcer showed no improvement after 42 treatments. This patient is a cook and must stand on his feet steadily for ten hours a day without rest. Although we have urged all of our patients to continue with their daily occupations, this individual was regarded as an exception to this rule because he was on his feet more steadily than any other persons in the series. It was observed that the ulcer always became more inflamed and painful during the latter part of each day's work, and because we feel that this patient has a complicating deep-vessel phlebitis, it would seem likely, in this one instance, that hospitalization would be necessary to insure a reasonable chance of healing.

The third patient, B. G. (case 53) had only four treatments in the course of one week, and then had to return to his home, about 150 miles from New York City. His family physician is now giving these treatments under our guidance.

TABLE I.
Treatments of Varicose Ulcers with Acetyl-Beta-Methyl-Choline Chloride Iontophoresis

Patient	Age in Years	Sex	Duration of Ulcer	Size of Ulcer	Duration of Treatment	No. of Treatments	Result
1. N.S.	55	M	12 years	1.8 by 1.7 cm.	6 weeks	18	Healed
2. B.K.	62	F	37 years	2 ulcers of 2 cm. diam.	6 weeks	16	Healed
3. M.A.	25	F	8 years	2.5 cm. diameter	16 weeks	60	Healed(re-opened)
4. N.A.	75	F	20 years	4.5 by 5 cm.	3 weeks	13	Healed
5. U.	62	F	25 years	7 by 5 cm.	9 weeks	50	Healed
6. S.R.	47	F	7 years	2.5 cm. diameter	16 weeks	16	Healed (5 treatments)
7. C.	50	F	23 years	11 by 6 cm.	6 weeks	16	Healed
8. J.	51	M	7 months	2 cm. diameter	5 weeks	13	Healed
9. B.C.	58	M	1 year	Left: 5.7 by 4.6 cm.; right: 7 by 4.1 cm.	8 weeks	22	Healed (13 treatments)
10. S.G.	57	F	10 years	3.5 by 0.5 cm. 3 by 4 cm.	10 days	7	Healed
11. E.N.	53	M	12 years	4.5 by 1.5 cm.	10 days	4	Healed
12. F. R.	49	F	3 years	3.5 by 2 cm. 1.5 by 1 cm.	12 days	5	Healed
13. E. D.	55	F	7 years	4.5 by 2 cm.	11 days	5	Healed
14. S.L.	30	M	4½ years	1.25 by 0.75 cm.	3 weeks	12	Healed
15. T.R.	57	F	25 years	1 by 1 cm.	8 weeks	24	Healed
16. A.V.	59	M	3 years	2.5 cm. diameter	2 weeks	5	Healed
17. U.H.	63	F	2 years	5.5 by 8 cm.	20 weeks	100	Healed
18. C.S.	48	F	20 years	11.5 by 3 cm.	16 weeks	47	Healed
19. C.A.	51	F	3 months	1.75 cm. diameter	1 week	5	Healed
20. R.F.	54	M	2 years	2.3 by 3.1 cm.	12 weeks	38	Healed
21. B.G.	36	F	3 years	1.6 by 1.2 cm.	6 weeks	24	Healed
22. T.S.	51	F	1 year	0.5 cm. diameter	6 weeks	11	Healed
23. G.S.	52	M	10 years	1.8 by 0.7 cm.	2 weeks	10	Healed
24. O.C.	63	M	1 week	2 ulcers of 0.5 cm. diameter	2 weeks	9	Healed
25. T.E.	45	F	3 years	2 cm. by 8 cm.	4 months	20	Healed
26. C.G.	62	M	10 years	1.8 x 0.7 cm.	2 weeks	10	Healed
27. E.I.	33	M	1 year	1.5 by 1 cm.	5 weeks	13	Healed
28. P.T.	42	M	10 years	1 by 1.8 cm.	3 weeks	12	Healed

TABLE I. — (Concluded on page 106)

TABLE 1. — (Continued)

29. T. McC.	53	M	2 years	7.5 by 7 cm.	6 months	44	Healed
30. C.M.	36	F	2½ years	1 by 1 cm.	6 months	34	Healed
31. R.S.	48	F	7 years	1 by 1.5 cm.	1 year	34	Healed
32. R.W.	48	F	6 years	2 by 2 cm.	2 months	14	Healed
33. T.C.	38	F	7 months	1 by 1.2 cm.	3 months	28	Healed
34. M.V.	47	F	6 years	3.5 by 2.2 cm.	2 months	24	Healed
35. M.R.	58	M	2 months	2.5 by 1.2 cm.	1 month	14	Healed
36. H.L.	66	M	6 years	7.1 by 4 cm.	1 year	168	Healed
37. H.T.	24	M	7 months	4 by 5 cm.	6 months	72	Healed
38. E.H.	39	F	1 year	2 by 1.5 cm.	3 months	25	Healed
39. E.C.	63	M	2 years		2¼ months	31	Healed
40. E.I.	33	M	5 years	1.5 by 1 cm.	1 month	13	Healed
41. F.P.	63	M	3 years	1.8 x 1.3 cm.	4 weeks	22	Healed
42. J.P.	42	M	10 years	1 cm. x 1.8 cm.	1 month	12	Healed
43. Mrs. L.	47	F	13 years	3.8 cm. x 2.5 cm.	1 month	10	Healed
44. S.P.	34	F	4½ years	Rt. 1.5 by .8 cm. L. .8 by .6 cm.	8 months	73	Ulcer same size but not as deep
45. J.E.	45	M	3 years	2 by .8 cm.	7 months	30	Smaller
46. C.M.	26	F	2½ years	1 by 1 cm.	8 months	37	.5 by .5 cm.
47. J.S.	36	M	10 years	4½ by 4 cm. 2 by 2 cm. 2½ by 2 cm. 1 by 1½ cm. 1 by 1 cm.	5 months	57	3½ by 4 cm. 1 by 1 cm. 1½ by 2 cm. Healed Healed
48. C.G.	58	M	1 year	2 by 2 cm.	5 months	39	Improved 1.3 x 0.5 cm.
49. J.A.	38	F	3 years		5½ months	23	No change
50. H.W.	64	M	5 years	4 by 4 cm. 5 by 4½ cm. 6 by 1 cm. 4½ by ½ cm. 1 by 1 cm.	2 months	54	1.2 x .6 cm. 3 x 2.5 cm. 3 x 1.2 cm. 1.8 x 1.5 cm. 1 x 1 cm.
51. H.R.	48	M	1 year	7.5 by 3.5 cm.	2 months 10 days	27	7.5 by 3 cm.
52. M.H.	63	F	14 years	6 by 3.5 cm.	2 months	41	3 by 1½ cm.
53. B.G.	57	M	6 years	5 by 2.5 cm.	1 week	4	Unimproved; stopped
54. S.E.	31	M	4 years	L. calf, 2.5 cm. diame- ter, ankle, 4.3 by 2.6 cm.	12 weeks	39	Not improved

Comment

The mechanism that is responsible for the healing of the ulcers under mecholyl iontophoresis is not yet definitely known. The increased circulation causing a more rapid absorption of the waste products and improvement of local nutrition, may be the principle factor in the regeneration of the pathologic tissue.

On the other hand, it may be the abundant diaphoresis produced by the mecholyl treatment, continuing 4-8 hours, which is the decisive factor in the therapeutic results attained. By withdrawing large quantities of liquid from the tissues the edema may be reduced and thus lead to regeneration of healthy tissue. Perhaps it is the combined action of the two processes which is responsible for the therapeutic results achieved with this form of treatment.

We realize that it is preferable to obliterate the causative veins as part of the treatment and have recommended injection therapy in suitable cases after the ulcer has healed. It is to be expected that if the etiologic factors are not removed, all ulcers of this type will tend to recur unless treatment is continued. There are, however, ulcers which do not heal after injections. In some cases, also, such as those involving diabetes or phlebitis, injections are not to be recommended. In these groups this form of treatment should have special value and we find such patients quite willing to continue to take treatments once a week or every ten days, to prevent the recurrence of their former condition.

1100 Park Avenue.

(Concluded on page 116)

ARCHIVES of PHYSICAL THERAPY, X-RAY, RADIUM

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

Editor: DISRAELI KOBAK, M.D., CHICAGO

EDITORIAL BOARD

Medicine — WILLIAM BIERMAN, M.D., *New York*; JOHN D. CURRENCE, M.D., *New York*; J. C. ELSOM, M.D., *Madison, Wis.*; F. H. EWER-HARDT, M.D., *St. Louis*; BENJAMIN GOLD BERG, M.D., *Chicago*; JOHN SEVERY HIBBEN, M.D., *Pasadena*; FRANK H. KRUSEN, M.D., *Rochester, Minn.*; EDGAR MAYER, M.D., *Saranac Lake*; MARY ARNOLD SNOW, M.D., *New York*; HARRY EATON STEWART, M.D., *New Haven*; NORMAN E. TITUS, M.D., *New York*; JAMES WILTSIE, M.D., *Binghamton, N. Y.*; HEINRICH WOLF, M.D., *New York*.

Surgery — GUSTAVUS M. BLECH, M.D., *Chicago*; JOHN S. COULTER, M.D., *Chicago*; E. N. KIME, M.D., *Indianapolis*; GUSTAV KOLISCHER, M.D., *Chicago*; WM. H. SCHMIDT, M.D., *Philadelphia*; F. H. WALKE, M.D., *Shreveport, La.*; GRANT E. WARD, M.D., *Baltimore*; A. D. WILLMOTH, M.D., *Louisville*.

Eye, Ear, Nose and Throat — A. R. HOLLENDER, M.D., *Chicago*; O. B. NUGENT, M.D., *Chicago*; F. L. WAHRER, M.D., *Marshalltown, Ia.*

X-Ray and Radium — HARRY H. BOWING, M.D., *Rochester, Minn.*; R. W. FOUTS, M.D., *Omaha*; R. E. FRICKE, M.D., *Rochester, Minn.*; IRA I. KAPLAN, M.D., *New York*; A. F. TYLER, M.D., *Omaha*.

Biophysics — ALBERT BACHEM, Ph.D., *Chicago*.

Biochemistry and Nutrition — VICTOR E. LEVINE, Ph.D., M.D., *Omaha*.

Foreign Collaborators — OSCAR BERNHARD, M.D., *St. Moritz*; H. BORDIER, M.D., *Lyons*; ELKIN P. CUMBERBATCH, M.A., M.B., (Oxon) M.R.C.D., *London*; A. R. FRIEL, M.A., M.D., (Univ. Dub.), F.R.C.S.I., *London*; SIR HENRY GAUVAIN, M.D., M.Ch., *Alton, Eng.*; F. HOWARD HUMPHRIS, M.D., (Brux.), F.R.C.P., (Edin.), D.M.R. and E. (Camb.); MOREL KAHN, M.D., *Paris*; JOSEF KOWARSCHIK, M.D., *Vienna*; FRANZ NAGELSCHMIDT, M.D., *London*; A. ROLLIER, M.D., *Leysin*; CARL SONNE, M.D., *Copenhagen*; ALBERT E. STEIN, M.D., *Wiesbaden*.

EDITORIALS

PRESENT CONCEPTS OF CANCER THERAPY

Until medical science shall have determined the etiology of malignant neoplasms their therapy must remain empiric without necessarily being irrational. The solution of the problem of cancer therapy at this time rests on the tripod — early diagnosis, surgical extirpation, and radiation. Of these components of the tripod only the early diagnosis has at no time been a subject for debate. The same holds good for surgery as a therapeutic measure, differences of opinion having arisen only about the manner of its utilization. Radical excision and its mutilating consequences have today their opponents and proponents you must take, but all are agreed that in the protection of life cosmetic restitution plays merely a secondary role.

The advent of electrosurgery has provided a new impetus to the surgical management of malignant neoplastic disease. Enthusiasts accepted the claim that the high frequency current utilized in the destruction or excision of a neoplasm seals the blood and lymph vessels, thereby preventing operative inoculation with malignant cells and consequent metastases, obviating the need for either pre- or postoperative irradiation. Unfortunately the otherwise unquestioned superiority of electrosurgical over classic operative procedures in cancer is not as great as we have been led to believe. While it is true that the high frequency current does seal small blood and lymph vessels, this in itself is inadequate to insure against a later appearance of metastases. It should not be overlooked that surgeons are rarely called upon to treat a patient for malignant neoplastic disease while it is still local in nature, so that in the overwhelming majority of instances metastases may already exist at the time of operation, even though they are not demonstrable by the methods at our command.

But even if we should have to consider a case in its very first stage, there is still a factor to be considered in our decision as to the proper manage-

ment of a cancerous growth. We know so little about the anatomy and physiology of the lymphatic system that the problem of the manner in which the larger vessels and the so-called lymph spaces cause the transport of cells into the general circulation is still one not fully solved. Camus and Gley have demonstrated before the French Academy of Sciences as early as in 1895, that the caliber of lymph vessels varies under nervous influences. More recently it has been demonstrated that the lymph channels react to the least mechanical insult by movements of a peristaltic character. Any manipulation of tissues, such as is necessitated during any kind of surgical division of structures, would undoubtedly produce a reflex peristaltic movement of the lymph and prove the means of carrying neoplastic cells from the operative field to distant parts. There is reason to assume that precisely such a course would take place even if we operated with a powerful high frequency current.

Under the circumstances it is rational to combine radiation with surgery. By this we mean pre-eminently irradiation of the operative field before operation, and this on the assumption that the x-rays may produce obliteration of the lymph channels in the entire operative field and thereby enhance our available safety measures. When one recalls that the larger lymph vessels consist of the three layers found in blood vessels, we may produce in them by irradiation a condition akin to pathologic endarteritis obliterans.

It is human that after observing good results from the electrosurgical operations for cancers, authorities will come to the conclusion that this method obviates the need for radiation, just as it is for specialistic radiologists to see in radium or the x-rays the sole means of combating malignant disease. Indeed, the question whether in certain types of malignant neoplasms irradiation is not followed by better results than the most radical operative method, has stirred the minds of some of the greatest surgeons. They rely on the statistics issued by large radiologic centers, but these are of little help to the average practitioner for whom each patient represents an individual problem that cannot be solved by a chart of percentages.

The stand taken by Kaplan in the symposium held at the New York session of the Congress and published elsewhere in this issue, is one that may well be accepted for general guidance. It is praiseworthy that a competent radiologist realizes the limitation of irradiation in malignant neoplasms and recognizes the necessity for a combination therapy of two principal elements, one of which is electrosurgery. Even with such a broad vision we are not immune against failures, for cancer represents too complex a problem to allow of definite grouping. By this we do not mean to imply that all efforts that have been made in that direction are useless, but to convey the idea that the cancer problem cannot be squeezed into a rigid system based on general experience.

This is particularly shown with cases of melanoma, management of which has been raised in the symposium just mentioned. The essayists and their discussants have properly stressed the importance of radical extirpation of this type of cancer. This, by the way, should be enlarged by the prescription to excise not only wide of the tumor but also to the greatest possible depth under it. Unfortunately clinical experience has taught many surgeons the sad lesson that even with such a radical procedure and the full use of irradiation they have been unable to prevent the rapid development of metastases virtually in every viscus until death frees the patient from his tragic fate.

Why certain types of melanoma should possess a virulence for which the word viciousness would seem more appropriate, it is not known. The ingenious theories advanced by Bloch, Masson, and others have proved of no es-

pecial clinical help so far as an amelioration of the prognosis is concerned. All we know with a fair degree of certainty is, that the virus of melanoma finds an open road in the lymphatic tract. At the risk of being charged with a *post hoc ergo propter hoc* reasoning, it is none the less a fact that when a melanoma is so situated that it can be extirpated with the attached lymphatic channel, the prognosis is far better than that of melanomata of the outer skin lying in a veritable lymphatic net. It is regrettable that melanomata other than of the skin are far and few between, and that such growths observed in the liver and other viscera are in all probability secondary or metastatic tumors, even if clinically it should prove impossible to demonstrate a primary source. It is evident that the whole problem of cancer control can be solved only through a nation-wide co-operation between organized medicine and the general population, for in the early, nay earliest detection of cancer lies also the effectiveness of its cure through irradiation, electrosurgery, with or without postoperative irradiation.

Correspondence

SHORT WAVE TEMPERATURE INTERPRETATIONS QUESTIONED

To the Editor:—Dr. Titus' comments on the article by Coulter and Osborne were read with great interest. Some parts of the original contribution left with me, too, a rather obscure mental picture, which at first I attributed to my own failure fully to comprehend the basis upon which the authors' data were interpreted. I refrained from submitting my own difficulties in the hope that a more exhaustive study of the article might reveal to us the system of logic employed.

Under the circumstances I was attracted by Dr. Titus' criticism and turned with sympathetic interest to the reply presented by Coulter and Osborne. I use the words "sympathetic interest" advisedly, because even with my rather limited experience in biologic research, upon both humans and animals, I learned that the ease with which errors are apt to creep into scientific reports is most disturbing to all workers.

Like Dr. Titus, I became convinced that the authors' conclusions on the heating effects of the various wavelengths do not conform to the data presented in the article, particularly those in chart 1. I was quite curious, therefore, to ascertain whether these discrepancies were to be attributed to a "slip of the pen," or could be logically clarified. I confess that I expected them to be classified as errors, and accordingly was disturbed to see them explained by a system of logic seldom presented in the scientific literature.

One of the most apparent discrepancies, as pointed out by Dr. Titus, is that between their data presented in chart 1, and the conclusions drawn from them. The authors point out that "the data confirm the previous findings that there are no significant differences in the heating of live human muscle or fat with different wavelengths of short wave diathermy current." Let us review the facts as presented by the authors.

As closely as we can interpret chart 1, the 24-meter wave produced a muscular temperature of about 104.3 degrees F. and the six-meter wave, 106.6 degrees F. — a difference of about 2.3 degrees. (See fig. 1.) The first question that suggests itself is: If, in the authors' opinion, a difference of 2.3 degrees is *not* significant (therapeutically), *what is the minimum difference which they consider significant?* Upon what basis have they determined this minimum difference?

In their reply Coulter and Osborne explain the discrepancies pointed out by Dr. Titus by suggesting that all experimental errors—to the extreme magnitude of one-half degree add up negatively in the case of the shorter wavelengths, and positively in the experiments with the longer wavelengths. This to my way of thinking is a rather daring assumption, as it not only reflects upon the confidence of the authors in their own technic and data, but fails to take care of the mentioned difference of 2.3 degrees.

The degree of error allowed by the authors (page 686) is one-half degree F. At best this

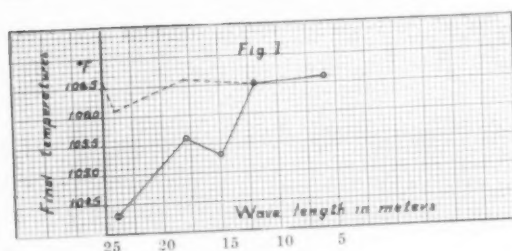


Fig. 1. — Key: Dashes (— — — —) indicate the final temperatures obtained by Coulter and Osborne, using the electromagnetic current at 25, 24, 18, and 12 meters. Remarkable uniformity of results, regardless of wavelength.

Line (— — — —) indicates the final temperatures obtained using the short wave currents at 24, 18, 15, 12, and 6 meters. The relationship of wavelength to temperature appears too definite to ignore. There is a difference of 2.3° F. between the final temperatures from the 24 and 6-meter waves. The authors viewed this as of no significance. The greatest difference between the two types of currents is in the 24-meter range where the effects from the electromagnetic current is about 1.8° F. higher than that from the short wave. This difference, 1.8° F., received recognition from the authors; but the effects at 12 meters, where both currents appear to heat equally, are ignored on the basis of "the error of observation."

can explain away one degree, which still leaves another 1.3 degrees to be accounted for. It is also worth noting that this statement of error on page 686, seemingly refers to subcutaneous and not to deep muscular temperatures. It appears to us that the latter are subject to less temperature variations than are the subcutaneous ones, thus rendering the suggested assumption still more precarious.

According to the authors (page 686), "each average reading" in the charts, "is an aggregate of at least six observations." This is important in relation to the assumption that all errors are added negatively in case of one wavelength, and all positively in case of another. Mathematicians tell us that the probability of six such errors occurring consecutively on one chosen side is $(1/2)^6$ — or one chance in sixty-four. But we are here dealing with not less than two such series "of at least six observations" each, which makes the probability not greater than $(1/2)^{12}$ or 1 chance in 4,096.

It is also to be noted that the above calculated probability does not include the magnitude of each error, but merely its direction. In their reply the authors not only make use of the direction of the error, but also intimate that each such error was of maximum magnitude, one-half degree. In their own words:

... we are not sure of the accuracy of the readings to within plus or minus one-half degree F. The aggregate of the errors might be all plus in one instance and all minus in another. For example, suppose muscle final temperature in the 24 meter reading is one-half degree low and that for the 6 meter is that much high.

By accepting their statement that the potentiometer used permitted accurate readings to within one-fifth of one degree the probability of each such error being of maximum magnitude (one-half degree) is, at the very best, 1 chance in 2-1/2 for each test. Applying this to the entire series of 12 observations reveals that the probability here is less than one fourteenth $(1/14)$

of the one calculated above about the direction of the error, namely, $(1/2.5)^{12}$ — or 1 chance in 59,311. Were one thus to carry the matter to a final mathematical conclusion, the probability that all the 12 errors would fall as suggested, each to the maximum magnitude, would be $(1/2)^{12} \times (1/2.5)^{12}$ — or 1 chance in 242,917,856!

To form conclusions on such a frail possibility would require something more weighty than the "wishful thinking" which the authors, quite appropriately expressed a desire to avoid. It appears, therefore, that the authors would do well by submitting a more detailed explanation of the methodology employed in deriving the conclusions submitted in their article.

On page 681, the authors state: "When using electromagnetic induction with a 24-meter wavelength, a temperature rise of approximately 1½ to 2 degrees F. was found above that when using the electric field." Since the latter field, however, showed a variation of 2.3 degrees F., within itself, according to wavelengths (see fig. 1) it seems well for those interested to carefully note the wavelength to which this comparison is confined.

There is, however, another problem the clarification of which we solicit, namely: Since in the case of the short wave field the authors consider a difference of about 2.3 degrees F. as of no significance, due in part to their own experimental errors, does the same criterion apply with equal force to the stated difference between the heating effects of the electromagnetic and the short wave currents — whether it be 24-meter, or otherwise? If not, why not? The authors' conclusions lead one to wonder whether or not the two "fields" are to be judged on different bases, or else the authors feel satisfied that their technic was less erroneous in the electromagnetic experiments than in those in the short waves. The above query is also prompted by the fact that the authors in a previous article ("Short Wave Diathermy," Arch. Phys. Ther., March, 1936), state the following: "The electromagnetic field produced the highest temperatures in the vagina with an average final temperature of 101.9 degrees F. or 1.9 degrees F. higher than the next machine . . ." "The next machine" referred to was a short wave machine. It is again to be noted that the "1.9 degree F. higher" temperature emphasized here, is 0.4 degrees F. lower than the 2.3 degrees F. which these same authors in their last article, chose to classify as of "no significance" in the case of short waves. Again, we are forced to ask, why? On what basis is 1.9 degrees F. emphasized in one case, and 2.3 degrees F. considered insignificant in another?

In discussing a scientific report, it should be one's aim not to restrict comments solely to errors of commission. Errors of omission, for example, may frequently project themselves most forcefully, and should, as a consequence, receive proper consideration. It seems, to me that one such error in the article by Coulter and Osborne is the inadequate discussion devoted to a comparison of their charts 1 and 2.

To illustrate, while the stated difference of almost two degrees between the heating effect of the electromagnetic and the short wave currents of 24-meter wavelength seems to be correct, the authors have omitted similar comparisons at the shorter wavelengths. Thus, in the case of the 12-meter wave, the charts indicate that the short wave field is as effective as the electromagnetic current, and that the 6-meter wave appears to be even a fraction of a degree more efficient. (See fig. 1.)

The authors state:

If one plots the value of the final temperature in the muscle tissue against wavelength, there appears to be on first glance a better heating effect with the six meter one. There is a temptation to let wishful thinking take charge of the conclusion that the shorter the wavelength the greater the internal heating.

Our graph (fig. 1) leaves with us a lasting impression "that the shorter the wavelength the greater the internal heating"; that is with the short wave currents, while the electromagnetic current gives no such indication. Note the dotted line in figure 1. In figure 2, I have presented graphically the results observed by Mortimer and Osborne. It seems to me that these data clearly indicate a higher heating by the shorter wavelength, not to be set aside as of no significance by either "wishful thinking" or experimental errors. It is to be regretted that the authors fail to emphasize this apparent importance of wavelength in the conclusion of their article.

I have as yet formed no definite opinion about the selective heating, or any other specific effect of either short wave or electromagnetic currents, but our present work may lead us into a closer study of this matter in the near future. In view of the extensive experience in such studies by the authors, Coulter and Osborne, one quite nat-

urally looks to them for helpful and authentic guidance, not only in technic but also in the interpretation of investigative data.

Their conservatism in regard to the *absolute* accuracy of their results deserves commendation. The reader is confused, however, by the manner in which experimental errors seem to be expediently utilized to relegate indicative data, into a classification of "no significance." The suggested assumption, for example, that all the errors in a series of experiments may be in the same, suitable direction, and of maximum magnitude is, to some of us, something new in science. We believe it appropriate, therefore, to again emphasize that a more detailed explanation of the methodology employed by the authors in arriving at the conclusions in their latest article is obligatory on their part.

SIMON BENSON, Ph.D.,

Department of Physiology,
University of Chicago

REPLY

To the Editor: Dr. Benson's comments on our article in the November, 1936 issue of the ARCHIVES are a healthy sign that progress is being made in physical therapy, when he considers it advisable to devote so much space to the arguments with reference to error in observation. We gather from his comments that he does not agree with our conclusions; at least not with the method by which they were reached. It would be well to reiterate that we are still of the opinion, in view of the many sources of error that can creep into observations, recognized and unrecognized, that there is no significant difference in heating effects of high frequency currents of 12,000 kilocycles (25 meters) to 50,000 kilocycles (6 meters) provided the tolerance of the patient is used as a control. Only too well are we aware of the difficulties confronting any one undertaking experiments on human or animal tissues; therefore, we feel indebted to Dr. Benson for calling our attention to this matter. When one remembers slight differences in thickness and construction of electrode pads and separation material, difference in depth of thermocouple insertion, difference in the patients themselves, difference in available power of the unit, in our opinion it would be difficult to conclude anything else based on our data. Until we have sufficient observations carried out so that the average initial temperatures for all wavelengths in the three categories for both electric field and electromagnetic field fall on nearly the same point, e. g., on 100 degrees F. for muscle, will we be inclined to favor promoting a conclusion which might be interpreted by some folks as denoting a difference in heating effect of various wavelengths examined. For example, in the electric field (chart 1) the initial muscle temperature for 24 meter wavelength is $\frac{1}{2}$ degree below, and the 15 meter, $1\frac{1}{2}$ degree below the 100 degree mark which apparently would be close to the norm. In the

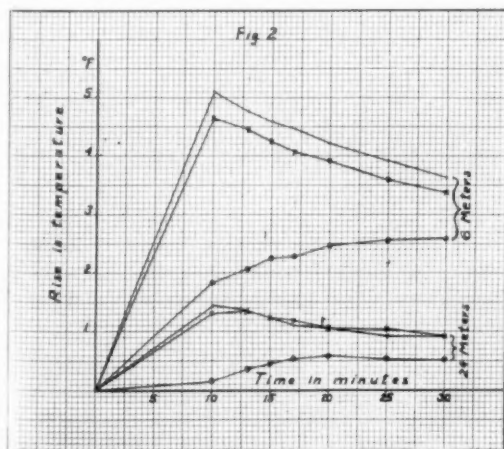


Fig. 2. — In the above illustration the three upper graphs represent the heating efficiency of the 6 meter wave, and the three lower graphs represent the heating efficiency of the 24 meter wave. Key: (—•—•—) Liver and duodenum; (—x—x—) Kidney and spleen; (—o—o—) Rectum. Temperature Rise in Degrees F. in Various Organs of the Dog after ten minutes' exposure to short wave diathermy. The graph is made from data taken from an article, "Short Wave Diathermy," by Mortimer and Osborne in the J. A. M. A., April 20, 1935.

electromagnetic field (chart II) the initial muscle temperature for the 18 meter wavelength is considerably (2+ degree) below the apparent norm. If we drew any other conclusion, we think we might be justly criticized for the above reasons; that is, the initial temperatures are not of the same magnitudes. Our clinical experience supports us in this contention.

Perhaps the unaccounted for 1.3 degrees or more might well be incorporated in the sources of error cited above, which for the moment we

do not know how to evaluate, but freely admit their importance and likelihood to mislead. What is really needed, therefore, is a larger number of experiments, carried out on a larger number of subjects, where one could be sure the countless errors in observation and technic would probably be at a minimum. Any further evidence brought forth by Dr. Benson would, of course, add to the present knowledge.

JOHN S. COULTER,
S. L. OSBORNE.

SCIENCE, NEWS, COMMENTS

Meetings of Physical Therapy Organizations

In this permanent column will be published information about meetings, election of officers, etc., of physical therapy organizations. New data should be sent promptly to the office of the Secretary, 1100 Park Avenue, New York.

American Congress of Physical Therapy; Cincinnati, September 20th to 24th; Dr. Richard Kovács, 1100 Park Avenue, New York, Secretary.

Mid-Western and Southern Sections American Congress of Physical Therapy will meet jointly with the St. Louis Medical Society, March 9, 1937. Dr. F. H. Ewerhardt, Chairman, Program Committee, 600 South Kingshighway, St. Louis, Mo.

Eastern Section American Congress of Physical Therapy will meet in cooperation with The New York Physical Therapy Society, The Pennsylvania Physical Therapy Society, The Essex County Medical Society and The Academy of Medicine of Northern New Jersey. The meeting will be held Friday, April 2, 1937, in the Academy of Medicine Building, 91 Lincoln Park, Newark, New Jersey. Chairman, Dr. Madge C. L. McGuinness, 1211 Madison Avenue, New York City.

New York Physical Therapy Society; meetings at the New York Academy of Medicine, on first Wednesdays from October to May; Dr. Madge C. L. McGuinness, 1211 Madison Avenue, New York, Secretary.

Kings County Medical Society, Physical Therapy Section; meetings at 1313 Bedford Avenue, Brooklyn, bi-monthly on second Thursdays; Dr. H. T. Zankel, 5 St. Paul's Place, Brooklyn, Secretary.

Medical Society of the State of New York, Session on Physical Therapy; Rochester, New York, May 26th; Dr. H. J. Harris, Westport, New York, Secretary.

Pennsylvania Physical Therapy Association; meetings at the Philadelphia County Medical Society Building, third Thursdays from September to June; Dr. Arno L. Zack, 216 East Broad Street, Bethlehem, Pa., Secretary.

New England Physical Therapy Society; meetings at Boston on second Wednesdays from October to June; Dr. William McFee, 41 Bay State Road, Boston, Mass., Secretary.

Pacific Physical Therapy Association; meetings at Los Angeles, fourth Wednesdays;

Latin-American Congress of Physical Therapy; Guatemala City, March 15th to 21st; Dr. C. L. DeVictoria, 1015 Lexington Avenue, New York, Secretary.

First International Conference of Fever Therapy; New York, March 29th to 31st; Dr. William Bierman, 471 Park Avenue, New York, Secretary.

Vitamin C May Be Essential for All Living Matter

Scurvy-preventing vitamin C, now obtainable in pure form as well as in fresh fruits and vegetables, may be essential for the continuance of even the simplest forms of life, according to the researches of Dr. Geoffrey Bourne and Russell Allen of the Australian Institute of Anatomy.

In recent technical communications to the scientific journal, *Nature* and the *Australian Journal of*

Experimental Biology, these two scientists pointed out that when the silver nitrate staining reagent, which is specific for vitamin C, was applied to such simple forms of life as protozoa, bacteria, yeast, seaweed and various parasitic fungi, black granules were found to be formed by its action, thereby indicating the presence of very small quantities of the vitamin. In view of these results the authors have "suggested that vitamin C is essential for the existence of living protoplasm."

These two scientists also find that the granules of vitamin C are greatest in number where the plant or animal is growing fastest and they consider that vitamin C plays a vital part in the chemical life of the living cell. — *Science News Letter*.

New York Physical Therapy Society

Memorial meeting for Frederic de Kraft, M.D., March 3, 1937, at 8:30 P. M., the New York Academy of Medicine, room 411, 2 East 103rd Street. Scientific Session —

1. "Dr. Frederic de Kraft, The Man," A. Bern Hirsh, M.D.

2. "Dr. Frederic de Kraft, The Pioneer in Physical Medicine," E. C. Titus, M.D.

3. "Survey of Instruction in Physical Medicine in Medical Schools," Franklin P. Lowry, M.D. (by invitation).

Discussor — Harold Rypins, M.D., Secretary, State Board of Medical Examiners.

Dinner preceding the meeting at The Croydon, 12 East 86th Street, at 6:45 P. M.

Jerome Weiss, M.D., President, 85 Buckingham Road, Brooklyn, N. Y.

Madge C. L. McGuinness, M.D., Secretary, 1211 Madison Avenue, New York, N. Y.

Dr. Titus Chairman, Section of Electrolgy of the Fifth International Congress of Radiology

The Fifth International Congress of Radiology will convene in Chicago, September 13-17, 1937, under the Presidency of Dr. Arthur C. Christie, of Washington, D. C. Previous conventions of this international body were held since 1925 in London, Stockholm, Paris, and Zurich.

The Section of Electrolgy, which meets as part of the Congress, will have as Chairman, Dr. Norman E. Titus of New York City, from whom information concerning its program may be secured.

Pacific Physical Therapy Association Meeting

The regular January meeting of the Pacific Physical Therapy Association was held in the Hollywood Hospital, January 27, 1937. The following program was presented:

1. "Who is a Cripple? A motion picture illustrating the importance of the mental attitude in chronic arthritis," by David H. Kling, M.D.

2. "The Relative Value of the Manipulative and Electrical Treatment of Post-Infantile Paralysis," by Wm. W. Worster, A.M., M.D.

Cancer Heals Itself; One Case in 100,000

The rare case of a cancer that spontaneously regressed or healed itself, an event that is estimated to occur "but once in one hundred thousand cases" is reported by Dr. M. Viola Rae of University of Toronto and Toronto General Hospital.

The malignant tumor, discovered in the kidney during an exploratory operation upon a woman 61 years old, had been surrounded and penetrated by calcium deposits and thus had died. After the removal, the patient "made an uneventful postoperative recovery." There was only one small piece of the tumor that was found to be alive.

Just what caused the cancer to heal itself is not known. Dr. Rae suggests that "some complex form of local or general immunity developed, which established retrogressive changes in the tumor." — *Science News Letter*.

Drop in Rickets Ascribed to Use of Vitamin D Milk

Discovery in recent years of methods of adding the sunshine vitamin D to milk and other foods seems to justify the hope that the public health problem of preventing rickets can be solved. Dr. Fred O. Tonney of the Chicago Board of Health told experts at a conference on irradiation held by the Wisconsin Alumni Research Foundation, which holds patent rights to one method of adding vitamin D to foods and medicines.

The individual child may be safeguarded from rickets by the guidance of his own doctor, but for the great mass of children in the country, many of whom do not obtain medical care unless seriously ill, preventing rickets seems to be the problem and responsibility of the health officer.

One measure of protecting large numbers of children against rickets may be the addition of vitamin D to milk. The value of vitamin D milk from the public health standpoint cannot be estimated definitely yet, because of the short time since its introduction and the small amount consumed. Dr. Tonney pointed out. However, in Chicago during the past year the consumption of fluid and evaporated vitamin D milk has amounted to 16 per cent of the total milk sales. During the same time severe rickets has disappeared and milder forms have declined noticeably in a group of preschool children examined regularly every year at child welfare stations, Dr. Tonney reported. He believes that vitamin D milk should therefore be given a more general trial as a rickets-preventing agent. — *Science News Letter*.

Vitamin C May Be Remedy in Infantile Paralysis

Scurvy-preventing vitamin C may prove to be a remedy for infantile paralysis, it appears from studies reported by Dr. Claus W. Jungeblut of College of Physicians and Surgeons, Columbia University, to the Society of American Bacteriologists.

Dr. Jungeblut's results were obtained with monkeys and not in human cases of the disease. He

cautions against drawing definite conclusions from his preliminary report but states that "there seems to be a strong probability that vitamin C when injected in proper doses possesses distinct therapeutic power in experimental poliomyelitis."

Vitamin C is found in many fresh fruits and vegetables and has also been prepared synthetically. Dr. Jungeblut injected this vitamin under the skin of monkeys on the day they were infected with infantile paralysis and every day thereafter for two and one-half weeks. One group of monkeys, untreated, served as controls. All these control animals developed typical infantile paralysis. Some of the animals treated with the vitamin did not develop the disease, others developed it without paralysis, and still others developed the disease in typical paralytic form. Apparently the amount of vitamin C given was important, large doses being less effective than small ones.

The monkey studies followed a previous discovery that when very small amounts of vitamin C are added to infantile paralysis virus in the test tube, the virus loses its disease-producing power. These small amounts of the vitamin are normally present in the central nervous system of man, Dr. Jungeblut pointed out. He believes that the presence of these small amounts of the vitamin may account for the fact that the great majority of humans are not susceptible to the disease. Those who are susceptible to it are not necessarily persons who do not get

enough of the vitamin in their diet. Glandular disturbance may prevent proper use of the vitamin by such persons, he suggests. — *Science News Letter*.

1937 Technicians' Registration Fee Due

Attention is called to technicians registered with American Registry of Physical Therapy Technicians that renewal of their certificate is necessary, as no certificate is valid without the imprint of the current year. Renewal of registration fee costs \$2.00. Checks should be mailed to Registrar, American Registry of Physical Therapy Technicians, 30 North Michigan Avenue, Chicago.

The Methodic Campaign Against Rheumatism

The Sixth International Congress on Rheumatism of the Ligue Internationale contre le Rhumatisme will be held in the University of Oxford at the end of March, 1938, while afterwards the tenth anniversary of the foundation of the Bureau of the Ligue Internationale will be celebrated during the bicentenary of Bath as a spa. The subjects to be treated and the names of the reporters will be communicated later on.

For further information apply to the Secretariate of the Ligue Internationale, Dr. J. van Breemen, Keizersgracht, 489/491, Amsterdam.

Iontophoresis of Varicose Ulcers — Kovács

(Continued from page 106)

References

1. Kovács, J.; Saylor, L., and Wright, I. S.: The Pharmacological and Therapeutic Effects of Certain Choline Compounds, *Am. Heart J.* 11:53 (Jan.) 1936.
2. Saylor, L.; Kovács, J.; Duryee, A. M., and Wright, I.: The Treatment of Chronic Varicose Ulcers by Means of Acetyl-Beta-Methylcholine Chloride Iontophoresis, *J. A. M. A.* 107:114 (July 11) 1936.
3. Danow, I.: Du traitement des ulcères variqueux par l'acétylcholine et de la possibilité d'appliquer ce médicament au traitement des ulcères de l'estomac, *Rev. méd. de la Suisse Rom.* 50:277 (April 25) 1930; also *J. de méd. de Paris* 50:619 (Aug. 14) 1930.

THE STUDENT'S LIBRARY

PHYSICAL THERAPEUTIC METHODS IN OTOLARYNGOLOGY. By *Abraham R. Hollender*, M.D., F.A.C.S., Associate in Laryngology, Rhinology and Otolaryngology, University of Illinois College of Medicine, Fellow of the American Academy of Ophthalmology and Otolaryngology. Cloth. Pp. 442 with 189 illustrations. Price, \$5.00. St. Louis: The C. V. Mosby Company, 1937.

The task of preparing a book at once scientifically authoritative and technically practical for everyday clinical problems in any branch of medicine or surgery is not an easy one, but in this objective the author has creditably acquitted himself. This monograph actually is the most exhaustive review of the progress of physical therapy in otolaryngology extant. Where but yesterday otolaryngologists utilized but a few primitive physical agents and methods in the management of inflammatory processes, the author has depicted the progress in this field by describing all of the acceptable forms of electrical, phototherapeutic, thermogenic and electrosurgical apparatus. He has expounded not only their therapeutic, including operative technic, but has clearly established their superiority over some of the older measures used in the treatment of diseases of the ear, nose and throat. Hollender has secured the collaboration of such noted authorities as Bierman, Friel, Jackson, Kobak, Krusen, Lederer, Looper, Newhart, Shapiro and Tyler, each of whom contributed one or more chapters on his respective field of endeavor, and has arranged the diverse texts in a manner as to constitute a homogeneous part of the entire work. The text proper is divided into 29 chapters, arranged as three parts. The first deals with the fundamentals of physical agents, the second treats of their clinical application in otolaryngology, and the last part is devoted to the problems of benign and malignant tumors and miscellaneous affections that could not be incorporated in the second part. Well executed illustrations enhance the lucidity of the text, visualizing apparatus, diseased conditions, and the technics of physical therapy. An extensive glossary and two carefully prepared indices complete the volume. Bibliographic references are provided at the end of each chapter. While both the scientific character and the contents of this monograph will not only appeal but prove of great value to otolaryngologists, general practitioners interested in physical therapy will find in the book guidance in the management of certain ear, nose and throat conditions that do not require specialistic attention. The author and the publisher are to be felicitated on this contribution to the literature of both otolaryngology and physical therapy.

THERAPEUTIC APPLICATION OF SHORT WAVES. (O Terapevticheskoj Primenenii Kоротыkh Voln.) By *B. V. Lichterman, M. A. Borodina, V. M. Linchenko and M. M. Orlov*. Published by Sechenovsky Institute of the city of Sevastopol, U. S. S. R. Cloth. Pp. 284, with 38 illustrations including photographic reproductions, 1936.

It is regrettable that the Russian language is mastered by comparatively few English speaking physicians, for the present volume represents one of the most informative contributions on the subject of short wave diathermy. Stimulated by the late Prof. A. E. Shtsherbak, to whose memory the work is dedicated, the authors began the study of the short waves about seven years ago without any preconceived notions. After thorough familiarization with the underlying physical and biologic factors they critically analyzed the world's literature on the subject, accepting nothing as working data without control tests. By the authors' own statement as well as perusal of the extensive bibliography given at the end of the book, the original material came from western Europe and the United States. After these exhaustive preliminary and preparatory labors the authors utilized their extensive clinical material in the famous southern city and environment for therapeutic investigation, for which they availed themselves not only of the technics proposed by the pioneers but of modifications devised by themselves. The book is a painstakingly exact report of their experiences, virtually every one of which has been presented with every indicated clinical and laboratory finding. The monograph is divided into 12 chapters, the first two of which are devoted to descriptions of their apparatus and technics. One notes a tendency to make use of exceedingly large condenser electrodes for treatments of the head (brain) and chest. The next chapter is an exhaustive study of reactions produced in healthy and sick humans, which is enhanced by the following chapter in which the authors present their observations of the influence of the short waves on the cardiovascular system. The material in these two chapters is so rich that it cannot even be enumerated in our allotted space. The bulk of the text is clinical in character and presents a most valuable study of the therapy of surgical infections, tuberculosis, rheumatic conditions, central and peripheral nervous affections, endocrine disturbances, muscular dystrophy, dermatoses, trophic ulcers and other indicated affections. In the concluding review the authors point out that the short wave therapy should not be regarded as a panacea, since it is not equally effective in different individuals suffering from one and the same disease. While they see no evidence of specificity, they also do not want the effectiveness of this therapy to be ascribed solely to heat. In their own words "the short waves effect an im-

pulse to the development of biologic reactions, the direction of which depends to a very large degree on the general state of the organism and of the correlated vegetative nervous system, which is the regulator of all physiologic functions of the organism, and which possesses a wide diapason in the sense of resonance to external stimuli." It is hoped that some enterprising American or British publisher will bring out a competent translation of the book, for that would prove a real service to the medical profession of the world.

WILLIAMS' OBSTETRICS. A TEXTBOOK FOR THE USE OF STUDENTS AND PRACTITIONERS. By *Henricus J. Stander, M.D., F.A.C.S.* Professor of Obstetrics and Gynecology, Cornell University Medical College; Obstetrician and Gynecologist-in-Chief, New York Hospital; and Director of the Lying-in Hospital, New York City. Seventh Edition. A revision and enlargement of the text originally written by J. Whitridge Williams. Cloth. Pp. 1239. \$10.00. New York: D. Appleton-Century Company, 1936.

It was generally feared that with the death of Williams his excellent textbook would have the fate of many works which became lost from memory with the demise of their creators. So intrinsic was the value of Williams' Obstetrics that the publishers are to be felicitated on their decision to preserve the fundamental structure of this tried text by entrusting its revision to the present author and editor whose long association with Williams especially qualifies him to carry on the work undertaken by his friend and teacher. Dr. Stander has brought the present volume down to date and has enriched it by distinctly new chapters dealing with the sex hormones and anesthesia in labor. Nor have the older chapters been left without subjection to critical and comprehensive revision, still more enhanced by the addition of suitable and well executed illustrations. Considering the popularity among medical students, practitioners and specialists which Williams' textbook has enjoyed for a large number of years no other evaluation of it is necessary than the statement that the profession will deeply appreciate and profit from its continued life and service as a clinical guide to the art of obstetrics.

THE 1936 YEAR BOOK OF GENERAL SURGERY. Edited by *Evarts A. Graham, A.B., M.D.* Professor of Surgery, Washington University School of Medicine; Surgeon-in-Chief of the Barnes Hospital and of the Children's Hospital, St. Louis. Cloth. Pp. 831 with 329 illustrations. Price, \$3.00. Chicago: The Year Book Publishers, 1937.

In 1936 review of the world's literature on general surgery is as rich in material and as ably edited as the preceding annuals. One may not always be in accord with the editor concerning the selection of articles abstracted in this book, but perusal of the more important ones shows that no worthwhile contribution of the past year has been overlooked. As with the preceding issues the editor

presents as an introduction a brief, nay too brief a resumé of the year's important original contributions to the science and art of surgery, and this is followed by the text proper, which runs the gamut from anesthesia-analgesia to orthopedic surgery. The last named subject appears as a section of 52 pages, rendering it questionable whether this recognized specialty had better not be published as a separate volume, provided the literature is more liberally represented. There are only two references to electrosurgery, showing that during the year just passed surgeons and authors have manifested little interest in this important addition to surgical technic. Like its predecessors, the 1936 annual is a representative literary resumé of the year's scientific progress in general surgery, and invaluable as a book of reference to practitioners and authors.

PARENTERAL THERAPY. A Ready Reference Manual of Extra-Oral Medication, etc. By *Walter Forest Dutton, M.D., and George Burt Lake, M.D.* Cloth. Pp. 386 with 90 illustrations. Price, \$7.50. Springfield, Illinois, and Baltimore, Maryland: Charles C. Thomas, 1936.

This book — its contents, arrangements, discussions, and style of presentation — is one of the most practical and timely contributions for students and practitioners of medicine and its allied disciplines. One does not need to argue the point that the patient seeks the physician's aid first for relief and then for information. The rapid advances in medicine often require speedy orientation to newer concepts in diagnosis and therapy, and since relief of symptoms is as important as the final objective — the cure of the disease, the physician's administrations must be so adaptive as to be able to meet any emergent state. Unfortunately information on methods of parenteral therapy which we agree with the authors include in the broadest definition electrophoretic or iontophoretic technics, is least described in a general text on therapy and is often only obtainable in house organs of pharmaceutical distributors. Undoubtedly the information may frequently be as useful as it is gratuitous, but the discord of competition leaves a final distrust and confusion to the detriment of those most in need of such therapy. This manual therefore fills a long vacant place in medical practice. It is rich in content, incorporating within the space of three special sections and an index, a comprehensive description of methods and technics of parenteral therapy which includes electroiontophoresis. The literary style is particularly pleasing because it makes use of the terse sentence and reduces whenever convenient, description and discussion to the abstract form. It includes descriptions of general technics of medication; of over 700 drugs with which parenteral medication is concerned; of the administration of serums, vaccines, glandular extracts, proteins, oils, biologic and pharmaceutical products, and the like. The book is a veritable gold mine of information concerning parenteral therapy and should be in the hands of every practitioner for convenient reference.

INTERNATIONAL ABSTRACTS

Treatment of Rhinophyma by Electrodesiccation. **Joseph V. Klauder.**

Arch. Dermat. and Syph. 33:885 (May) 1936.

Klauder regards the following method of treating rhinophyma by electrodesiccation as superior to that of surgical ablation. Local anesthesia is employed. The electrodesiccating needle (unipolar method) is inserted into the rhinophyma. The current is turned on sufficiently long to allow the area treated to become quite blanched. This blanched area is trimmed away with a scalpel down to undesiccated tissue, which bleeds freely when cut. The blanched area bleeds little if at all and cuts with a resistance comparable to that of a raw potato. If necessary, the needle is inserted into the same area and more tissue is desiccated, which in turn is cut away. This procedure is repeated at different areas until the entire rhinophyma is destroyed. Judgment must be exercised in order not to destroy too much or too little and to maintain the normal contour of the nose.

Ionization Treatment of Hay Fever. Clive Shields.

Practitioner 136:645 (May) 1936.

The author shares the very general prejudice against the introduction of drugs through the skin by ionization in the treatment of various conditions, first, because their action in the quantities in which they are applied must be very slight, owing to the "flushing" action of the blood and lymph streams; second, because they are more efficiently administered in properly controlled dosage by other routes. The problem of intranasal ionization is, however, different for here the effect is entirely local and the nasal mucosa can be impregnated with an insoluble substance which remains *in situ* for several hours. On theoretical and practical grounds intranasal ionization of zinc sulphate is a justifiable and valuable method of treating hay fever and vasomotor rhinorrhoea.

Influence of Ultraviolet Irradiation on Frog and Limulus Hearts Subjected to Potassium Excess. S. A. Guttman.

J. Cell. and Comp. Physiol. 8:37 (April 20) 1936.

The rhythm of the frog and clam hearts is myogenic while that of the limulus heart has been proved to be neurogenic. Guttman reported in 1935 that the frog heart, subjected to ultraviolet irradiation, exhibited a primary increase in frequency. The same holds true for the neurogenic limulus heart. When the clam heart was subjected to ultraviolet a marked amplitude decrease appeared while the pace maker was apparently unaffected.

Ultraviolet is therefore capable, regardless of its effect on the normal rhythm of cold blooded animal hearts, of overcoming the effects of potassium excess. It is possible that ultraviolet as suggested by Guttman, in 1935, produces an increase in permeability and a shift in potassium-calcium equilibrium. Thus, calcium may enter the cell and enable a normal equilibrium to be attained. This physical shift may, in part, account for some of the biological effects of ultraviolet irradiation.

Physical Methods of Endocrinotherapy. A. P. Cawadias.

Brit. M. J. 3943:215 (Aug. 1) 1936.

Therapeutic action on the endocrine organs can be effected by various methods: By endocrine organotherapy, by psychotherapy, by dietetics, by certain drugs, but principally by physical methods. The action of physical agents on endocrine function is effected through four distinct mechanisms, acting often in combination: (1) The ionic equilibrium mechanism; (2) the skin endocrinotropic mechanism; (3) the nervous reflex mechanism; (4) the direct glandular mechanism. The ionic equilibrium mechanism re-establishes a normal ionic equilibrium through physical agents. As normal ionic equilibrium means normal permeability of the cellular membrane and normal reactivity of the cells, re-establishment of this equilibrium renders the cells more susceptible to hormonal influences. Many authors have demonstrated an increase of blood calcium in hypocalcaemic conditions after ultraviolet irradiation. The ratio K:Ca is modified, potassium diminishing in relation to the calcium. Patients are often seen with distinct hypothyroidism in whom even strong doses of thyroid have no effect. This is because their hypothyroidism is not determined so much by insufficiency of thyroxine as by the fact that thyroxine does not act on the cells. If ultraviolet irradiation is given their condition improves, because the ionic equilibrium of the pericellular fluid is re-established, and thus the thyroxine is able to act.

Progress in physical medicine has confirmed the view that the skin is not an inert covering, but an endocrine organ functioning through the basal cells of the epidermis. The skin probably possesses, besides its specific hormonal action on calcium metabolism, a systemic hormonal action comparable to that of the pituitary — that is, it produces certain factors (hormones?) which stimulate other endocrines.

The nervous reflex mechanism represents the influence of physical agents on the nervous vegetative termination of the skin. These determinations are extremely numerous. When they are influenced by physical agents they set up nervous

vegetative reflexes through which the endocrine organs are influenced in their function. We find this mechanism acting in ultraviolet irradiation, in creotherapy, and in climatotherapy.

The direct mechanism consists in direct action of physical agents on the glandular elements of the endocrine organs. This is effected by certain penetrating radiations the most important of which are roentgen rays. Electromagnetic radiations produced by diathermy have a similar influence, as shown by the work of Dausset. The same can be said of the electromagnetic radiations produced by galvanic, faradic and sinusoidal currents. Through such a local mechanism either stimulation or depression may be obtained. Thus thyroid function can be obtained by ultraviolet irradiation of the whole surface of the skin. Ultraviolet irradiation of the skin increases basal metabolism. Children with hypothyroidism are distinctly benefited by ultraviolet irradiation. Ovarian function is effected by general ultraviolet irradiation. The stimulation can be explained either by the mechanism of ionic equilibrium re-establishment or by the nervous reflex mechanism, or by a gonadotropic increment of the skin. Ultraviolet irradiation accelerates the onset of puberty with rapid development of the breasts and pubic hair. This same irradiation or by diathermy acts beneficially in ovarian hypofunction with menstrual disturbances — oligomenorrhea, amenorrhea, irregular menstruation, dysmenorrhea, and the menopausal syndrome; obesity of ovarian origin is also favorably influenced. Ultraviolet rays also act synergetically with the parathyroids. We find that distinct stimulation of the incretory functions of the skin results in the production of viosterol, which influences calcium metabolism, if not on the same level as the parathyroid hormone, at all events in parallel.

Recovery of Influenza Virus Suspended in Air and Its Destruction by Ultraviolet Radiation. W. F. Wells, and H. W. Brown.

Am. J. Hyg. 24:407 (Sept.) 1936.

Suspensions of microorganisms in air, produced by substantially instantaneous evaporation of atomized droplets of liquid suspensions, may drift alive in the air for hours or days. In this manner large numbers of nasopharyngeal organisms may be dispersed into the atmosphere by sneezing, and it has been shown that bacteria originating in the nasopharynx may normally be recovered from the air of crowded rooms. The persistent belief in the air transmission of certain virus diseases makes it important to determine whether virus suspensions in air, too, are viable and whether bactericidal light will destroy such air suspensions of viruses.

A Hanovia bacterial testing chamber containing a cold quartz mercury vapor lamp was built into the sampling line of one of the centrifuges. This arrangement permitted simultaneous sampling, under identical conditions, of air as it came from the tank and similar air after irradiation with ultraviolet light of an intensity found to have a marked bactericidal effect. In-

to the tank air was atomized the filtrate of an emulsion of ferret lung. At the end of ten minutes, sampling into diluted physiological saline was begun. The two tests seem to show a definitely viricidal action of ultraviolet light. In both instances the ferrets which were inoculated with material recovered from the untreated air of the tank suffered a typical attack of influenza, which was confirmed by virus neutralization tests. In both instances ferrets which were inoculated with irradiated material which was recovered from the air of the tank simultaneously with that given the ferrets mentioned above failed to show any symptoms of influenza. Virus neutralization tests with serum obtained from the ferrets inoculated with the irradiated material before and after the experiment indicated that no antibodies to the P. R. 8 virus had developed, which confirmed our belief that the ultraviolet light had killed the virus.

Treatment of Angioma of the Face. Frederick A. Figi.

Arch. Otolaryng. 24:271 (Sept.) 1936.

The most effective agents and procedures for the treatment of hemangioma of the face are, in the order of their usefulness, radium, electrocoagulation, excision and injection of sclerosing substances. Ligation of the afferent vessels and various plastic procedures are frequently used to supplement these measures. Other procedures have a much more limited field of usefulness. While the results obtainable with these forms of treatment vary greatly, choice of therapy is usually determined largely by the experience of the clinician with any one or group of them.

Although adults not infrequently have this type of tumor, the great majority of patients with angioma are children. Both hemangioma and lymphangioma occur about the face, but the former is more common and accordingly is of greater clinical importance. Hemangioma is most commonly classified as (1) capillary or (2) cavernous. Fraser's classification includes a third type, which he designated compact hemangiomas. Cases in which a capillary or a cavernous hemangioma spontaneously disappeared have been reported in the literature. At present radium is generally considered the most effective agent for dealing with hemangioma, especially of the face. Prior to the introduction of radium in the treatment of this type of vascular growth, surgical excision was the therapeutic method of choice, and it is still so considered by a number of able general and plastic surgeons. It appears that the results of irradiation observed by surgeons favoring the excision of angioma must have been unusually bad, and one cannot help wondering if the treatment was given by an experienced radiologist. Radium may be administered in several forms: (1) in a surface pack, using distance and screening, (2) in a plaque or in tubes applied directly to the surface of the lesion, and (3) in needles or as radon seeds implanted into the tumor. At the Mayo Clinic, patients in early childhood who have a cavernous angioma on

the face measuring several centimeters or more in diameter usually receive treatment with radium packs. When a radium plaque is used it contains from 5 to 25 mg. of radium element. The plaque is most effective in the treatment of capillary angioma. Electrocoagulation has greatly improved the results of treating cavernous angioma in adults. Frequently it is of decided advantage to precede electrocoagulation by ligation of the afferent and efferent vessels supplying the tumor. While surgical excision has been supplanted to a great extent by radium therapy and electrocoagulation in the treatment of angioma of the face, in certain cases hemangioma can be dealt with more satisfactorily by means of surgical excision. Epithelioma has frequently been observed which has developed in the dense scar left by the treatment with radium of a capillary angioma or of a mixed capillary and cavernous angioma. The injection of a sclerosing substance in the treatment of angioma is generally considered a comparatively recent development. It is said to be more effective in dealing with cavernous angiomas, but it has also been used in the treatment of capillary angioma. One of the outstanding advantages cited for injection treatment is the fact that the patient is ambulatory. In the course of time this method will probably supplant some of the older methods of therapy.

Recent Diagnostic and Therapeutic Advances in Peripheral Circulatory Disease. J. Ross Veal.

New Orleans M. & S. J. 88:682 (May) 1936.

Mention is made of the group of patients who are subject to what may be termed recurrent attacks of vascular occlusion. Gradual occlusion of the arteries can be withstood in most cases, for the collateral circulation develops parallel with the pathologic process, but when abrupt occlusion occurs, the nourishment of the extremity is suddenly jeopardized. Such occlusion constitutes an acute emergency and demands emergency measures of relief. If an embolus is the cause, as can now be positively determined by arteriography, embolectomy is justified, for loss of life or at least of limb is inevitable if less drastic measures are adopted. Most patients, however, can be carried through the emergency by other less radical measures. These include absolute rest, the use of superheated air, hypodermoclysis with Ringer's solution, the intraduodenal administration of large amounts of hypertonic salt solution, the intravenous infusion of such agents as sodium citrate, and in particular, the use of alternating positive and negative pressure by means of the Pavaex machine devised by Herrmann and Reid or the similar apparatus recently described by Landis and Gibbon.

How these measures are to be used, in what combinations and for what conditions, must be the decision of the individual physician after his study of the individual patient. The important thing to realize is that the new conception of peripheral vascular disease implies the consider-

ation of the patient with this disease as an individual who can be spared much, if not all, the disability and mutilation that formerly was inevitable in it. The brilliant results secured by Hermann, Landis, as well as by many others, are a challenge to all surgeons everywhere to duplicate what they have done, an achievement that is not impossible if the diagnostic and therapeutic advances outlined are consistently and properly employed.

Therapeutic Experimental Iontophoresis. P. M. Besse; K. M. Walthard; R. Mittendorf, and E. Perottet.

Ann. de méd. phys. 4:76, 1936.

The authors remind us that they introduced vaccination and tuberculin testing by iontophoresis, as well as calling attention to the advisability of warming the part before attempting to apply galvanism. Quantitative urinalysis was performed on eight different patients who were treated with potassium iodide iontophoresis for 20 minutes at 15 ma. When the second group of four had a previous application of histamine for 2 minutes at 8 ma., it was found that the urinary output of KI was doubled (from 4.4 G. per liter to 8.5 per liter). Less striking results were obtained when sodium salicylate was substituted for KI, but when a mud pack at 50 degrees C. was used before salicylate iontophoresis, the urinary output of the chemical was almost doubled.

Treatment of Cervicitis and Endocervicitis by Electrophysical Modalities. William H. Guilium.

Med. Rec. 143:428 (May 20) 1936.

The author's experience extends over 237 cases, 141 of these being chronic endocervicitis with cervical erosions, more or less extensive. Many were associated with nabothian cysts, others with more or less extensive masses of hard cicatricial tissue and varying deformity due to contracture. Ninety-nine cases were early gonococcal and non-specific cervicitis without apparent tissue changes, also cervicitis complicated by simple follicular or papillary erosions. The reports reviewed definitely indicate that in the treatment of endocervicitis, cervicitis with cervical erosions, physical therapeutic measures are now achieving more satisfactory results than those which formerly followed medical or surgical procedures. Monopolar (desiccation or fulguration) or bipolar (coagulation) high frequency is preferred to cauterization, these modalities alone completing ninety-five per cent of all types of cases. Ionization is effective in some endocervicitis and erosions, but principally of the milder type. These procedures may be carried out with the patient ambulatory, except in the rare case in which for some reason general anesthesia is required. The use of "cold" ultraviolet rays may have a useful field in a limited number of cases.

Influence of Radio Ultrashort Wave Therapy on Experimental Tuberculosis in Guinea Pigs.
David H. Kling, and Henry M. Rubin.

Am. Rev. Tubercul. 34:498 (Oct.) 1936.

Radio short wave and ultrashort wave therapy has for several years been employed in the treatment of various conditions. A number of investigations have been published on the action of these high frequency currents on various plant and animal tumors and on bacteria including the tubercle bacillus.

Dr. Emil Bogen, pathologist of Olive View Tuberculosis Sanatorium, Olive View, California, put at our disposal 10 guinea pigs, out of a group of 200 animals simultaneously inoculated with 0.001 mgm. of tubercle culture. Each animal received 20 to 21 treatments of 10 minutes each with a Falconer Transtherm of 6 metre wavelength and 150 watt output. Three different modalities were used: (1) General condenser field: Three animals were placed in a 2-litre pyrex beaker and 6 by 8 inch condenser electrodes were placed on the top and bottom. In this way the whole body was within the electric field. (2) Local condenser field: 3 by 4 inch condenser plates were placed over the back and abdomen of four animals, covering the site of inoculation and inguinal lymph nodes. A one-half inch rubber sponge was interposed between the abdomen and the plate. (3) Electromagnetic field: Three animals were placed in a 2-litre pyrex beaker. The walls of the beaker were surrounded on a solenoid consisting of seven turns of $\frac{3}{8}$ -inch copper bands connected to the machine. This created an electromagnetic field within the beaker. Extensive investigations of this modality will be reported elsewhere.

The ten pigs treated with three different modalities in the electric and electromagnetic fields of a 6-m. ultrashort wave apparatus, showed no influence in the development and progression of tuberculous infection and lesions, as compared with a large control group. Weak or strong dosage, as evidenced by a slight or strong rise in temperature, did not seem to have any influence on the development of the tuberculous process. With 20 or 21 exposures during the course of three months the 10 animals showed no deleterious effects or complications. By careful technique burns were avoided with all modalities applied. While the results of this experiment support the opinion of Schedtler that the eventful beneficial effect on human tuberculosis is apparently due to hyperaemia and heating rather than to any specific action, it should be pointed out that Kling and Rubin's conclusions apply only to the conditions of the experiment and that the number of animals treated were too small to warrant any generalization.

Fundamentals of Allergic Rhinitis With Particular Reference to Ionization (Iontophoresis).
L. W. Dean.

Ann. Otol., Rhin. & Laryng. 45:326 (June) 1936.

This report is based on a person who was ionized two years ago and came to the clinic complaining of postnasal discharge. The history suggested that she was ionized because of perennial allergy. Since her ionization she has been free of a very troublesome nasal obstruction. At this time the patient presents a mild rhinitis sicca. The middle turbinates were covered with thin crusts. With the removal of the crusts, superficial excoriations were found. The mucous membrane was paler and dryer than normal; there was no nasal obstruction. Nasal smears showed an increase of eosinophils and many polymorphonuclear neutrophils. The blood eosinophilia was 8 per cent.

A biopsy was taken from the middle third of the inferior turbinate. There was a hyperplasia of epithelium, some areas showed ciliated cells, others were covered with squamous cells; there were no goblet cells. The basement membrane was much thickened and more dense than normal. The tunica propria was thin and fibrous. The fibrous tissue looked like scar tissue. There was a scattering eosinophils in the tissue; they were slightly increased in number. Most of the glands appeared to be functioning; many were permanently atrophied. Around the acini were distinct inflammatory changes. The walls of the capillaries were thickened. This was not true of the larger vessels. This is the only biopsy of human ionized turbinate that we have studied where there was no edema. Intramucosal tests produced subjective reactions, headache, feeling of malaise but no nasal stoppage; that is, the turbinates did not touch the septum.

With these changes in the membrane, one would hesitate to do repeated ionizations. True atrophic rhinitis cannot result from ionization; rhinitis sicca is often present after the ionization. It has lasted at least two years. The more allergic the individual, the less persistent is the dryness of the membrane. A severe attack of hay fever in an ionized nose is almost certain to leave behind evidences of vasomotor rhinitis. With repeated attacks of acute allergic rhinitis the pale color of the membrane decreases, nasal obstruction with sneezing reappears.

Ionization improves cases of allergic rhinitis. The less the sensitivity to allergens, the greater the relief. Ionization does produce deleterious results in the mucous membrane of the nose which last at least two years. Many changes are permanent. There is no excuse for using ionization if procedures that do not produce deleterious results will give a satisfactory result. Ionization should not be used unless the benefits derived are greater than the deleterious results produced.